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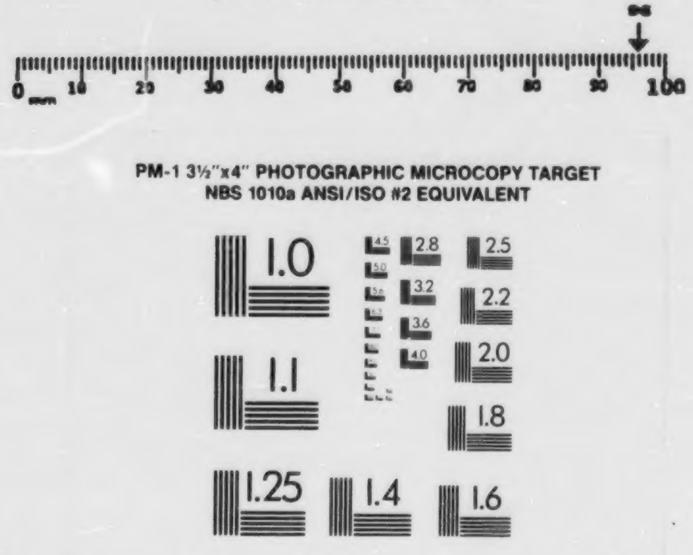
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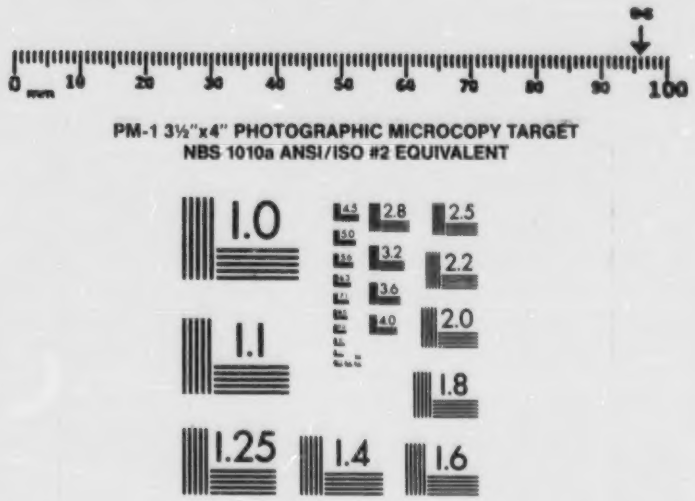
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REPORT ON

RED DEER RIVER INSTREAM FLOW NEEDS STUDY

Submitted to:

Fisheries Management Division
Alberta Environmental Protection
Cochrane, Alberta

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March 1999 **972-2333**

EXECUTIVE SUMMARY

A study was initiated in 1991 to determine the instream flow needs, or how much water must be left in the river, to protect the physical fish habitat of the Red Deer River between the Dickson Dam and the Saskatchewan border. The study began with an examination of the physical characteristics of the river, to identify river sections that exhibit relatively uniform habitat types. The result was the identification of four river segments between the dam and the border: 1) from the border upstream to the Drumheller area; 2) from the Drumheller area to the Blindman River confluence; 3) from the Blindman River to the Medicine River confluences; and, 4) from the Medicine River confluence upstream to Dickson Dam.

Within each river segment, one representative section of river between 800 m and 1 km long was selected for detailed study. Each of the four study sites chosen exhibited the characteristics of the much longer river segments they represented. Within each study site, transects were established across the river through each of the habitat types present. Between six and ten transects were established at each of the study locations. Measurements were made at each transect during the low flows which prevailed in the fall of 1991, and high and medium flows during the spring of 1992. The features which were measured across the transects included water depth and velocity, the bottom type (substrate) and the presence or absence of cover for fish. This information was entered into a computer, and used to simulate how depths and velocities change, and what bottom types and cover are present at each study site at any flow within the range of flows that were measured. Once the data decks were calibrated, the computer simulation programs were able to predict the habitats that would be present for fish throughout the ranges of flow found in each river segment.

The second component of the study involved determining the habitat conditions required by the species of interest in the various river segments. The species targeted for management in the Red Deer River downstream of Dickson Dam are brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*), walleye (*Stizostedion vitreum*) and goldeye (*Hiodon alosoides*). Divers were used to identify the habitat conditions important to each life stage (spawning, fry, juvenile, adult) of each of the target management species, where visibility permitted. In sections of the river too turbid for visual observations, boat electrofishing was used to determine fish positions in the river. Following the marking of fish locations, water depth and velocity were measured, the bottom type was recorded, as was the presence or absence of cover at each marker. These physical habitat features were then attributed to the particular life stage of the species of fish which was noted at that locale.

For some life stages of the target management species, habitat preference information is available from other Alberta streams (i.e., Bow, Highwood, and Oldman rivers). For these life stages, a minimal number (25) of observations was obtained from the Red Deer River, to see if the habitat preference information from the other watersheds was transferable to the Red Deer River. None of the habitat preference information was found to be transferable, and therefore a complete habitat preference criteria study was required for each target life stage for the Red Deer River. In a complete criteria study, a larger number of observations (150) for each life stage is obtained, and this information is assembled and analyzed to determine the specific habitat types each life stage preferred. The information on habitat preferences, or the relative usefulness of each habitat feature for each life stage, is then entered into the computer. The computer is then used to simulate habitat conditions over a wide range of flows, and the information on habitat preferences is used to define how habitat changes with flow rate for each life stage at each study site (termed the habitat/flow relationship). The relationship between habitat and flow is the primary tool being used to define the instream flow requirements for fish in the Red Deer River.

Collection of biological information on the habitat preferences of the target management species was initiated in 1991 and continued in 1992, 1993 and 1994. Habitat preference information for one or more life stages of each of the four target species was incomplete. Not all of the required data could be collected for the identification of the habitat preferences of all of the life stages of the target management species, largely due to insufficient numbers of certain life stages within the Red Deer River. As a result, generalized habitat-preference criteria were developed for these life stages, by combining Red Deer River data with data collected elsewhere in the South Saskatchewan River drainage. These curves were then subjected to an expert review and refinement, by individuals knowledgeable of the target fish species and the aquatic environment of the Red Deer River.

Based on the revised habitat preference criteria, instream flow needs were determined for all life stages of the target management species. Fish Rule Curves (operating rules) were then developed to summarize the instream flow needs of fish in the Red Deer River downstream of Dickson Dam in Alberta.

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1. INTRODUCTION

The Fish and Wildlife Management Division of Alberta Environmental Protection is involved in an Instream Flow Needs (IFN) study for fish in the Red Deer River, for the section of river extending from the Dickson Dam downstream to the Alberta/Saskatchewan border (Figure 1). The results of the study will ultimately be used by the Division to determine suitable flow regimes to protect and manage the fisheries of the Red Deer River.

The fisheries component of the Red Deer River IFN study involves the identification of the amount of water required to provide the physical habitat necessary to sustain the Red Deer River fisheries resource between the Dickson Dam and the Saskatchewan border. This task is being accomplished by defining the relationship between river flow and habitat availability for the target management fish species for the lower Red Deer River. These target species are brown trout, mountain whitefish, walleye and goldeye.

The IFN study was conducted with the use of the Instream Flow Incremental Methodology (IFIM) developed by the former Instream Flow and Aquatics Group of the U.S. Fish and Wildlife Service, Ft. Collins, Colorado. The IFIM is a powerful tool which uses hydraulic simulation to determine the relationship between habitat and flow for the specific fish species selected for management consideration. This portion of the IFIM analysis employs the Physical Habitat Simulation System (PHABSIM) group of models (Milhous *et al.* 1984). The PHABSIM group of models was developed to predict habitat availability over a wide range of flows for the species and life stages of interest. The relative value of each habitat characteristic for the species and life stage under examination must be identified to facilitate an estimation of habitat suitability. To this end, the habitat preferences of the most commonly encountered life stages of the target sport fish species within the study area must be determined. With the use of this preference information, the relationship between habitat availability and streamflow can be determined over a range of flows in the study stream.

Golder Associates Ltd. (Golder) was contracted by the Alberta Environmental Protection (AEP) to conduct the IFIM study. In addition to the fisheries component, AEP is addressing the flushing and channel maintenance flow requirements, and water quality requirements of the Red Deer River within the IFN study area.

The Red Deer River IFIM study was initiated in 1991. Hydraulic measurements were conducted over a range of flows in the fall of 1991 and the spring of 1992. Collection of biological data regarding the habitat preferences of each of the life stages of the target fish species was initiated in 1991, and continued in 1992, 1993 and 1994.

2. APPROACH

The Red Deer River was divided into four river segments between the Dickson Dam and the Saskatchewan border, each of which exhibit relatively homogeneous physical characteristics. Within each river segment, a single study site was established where the physical features of the river segment were present. The physical characteristics (depth, velocity, substrate and cover) of each study site were measured at a series of flows. This information was used to calibrate the IFIM computer models which are used to predict the distribution of these physical characteristics at any flow rate within the range of flows measured.

The biological component of the IFN study involved identifying the habitat preferences of each life stage of each of the four target management species that were selected by the Fish and Wildlife Management Division. The target management species were identified as: walleye (all life stages in Segments 1 and 2, fry, juvenile and adult in Segment 3, adult only in Segment 4); goldeye (fry, juvenile and adult in Segments 1 and 2); brown trout (juvenile and adult in Segment 3, fry, juvenile, adult and spawning in Segment 4); and, mountain whitefish (fry, juvenile, adult and spawning in Segments 3 and 4). Completion of the identification of habitat preferences provides a definition of the range of habitat features (i.e., range of depths, velocities, substrate, and cover types) used by each life stage. Within each of the physical habitat categories, the suitability of the habitat feature is also rated, from unsuitable for use through to optimal for the life stage of interest.

The biological habitat preference information is then combined with the computer simulations of how habitat features change with flow in each study site. This procedure results in a definition of how habitat availability changes with flow (the habitat/flow relationship) for each life stage of each of the target management species.

The relationship between habitat and flow for each life stage of interest of each target management species for each of the four study sites is then used to develop streamflow recommendations for the maintenance of fish habitat. Typically, streamflow recommendations (termed Fish Rule Curves) are then identified on the basis of the assemblage of life stages present during each week of the open-water season, the habitat-flow relationships for each of these life stages, and natural water availability in the basin.

Prior to finalizing streamflow recommendations for the protection of fish habitat, input is required from several other disciplines involved in the IFN study of the Red Deer River. As river regulation may result in changes to the habitats present in the river, confirmation is required from river-regime specialists that any proposed operating plan will not result in changes to the basic nature of the river.

Input is also required from specialists regarding the flows required to occasionally flush the fines which typically accumulate during low-flow periods in rivers. In an unregulated river, these fines tend to be flushed from the system during the high spring flows. In a regulated river, these high spring flows are often stored, with the water being released during subsequent low-flow periods. This may result in the accumulation of sediment in the river, to the detriment of the aquatic life in this environment. An additional aspect of the IFN study for fish is therefore a determination of the frequency, duration and magnitude of flows required to flush accumulated sediment from the river.

Water quality is an equally important factor in identifying streamflow requirements for fish in the Red Deer River. Several water quality characteristics which may be affected by flow rates (e.g., water temperature, dissolved oxygen concentrations) dictate whether or not a particular region of the river will be suitable for use by various life stages of the target management species. Input from specialists is therefore required to ensure the water quality characteristics resulting from any particular water management strategy are suited to the requirements of the fish species of interest.

3. METHODS

3.1 River Segmentation and Study Reach Designation

The Red Deer River, from the Dickson Dam to the Alberta/Saskatchewan border, was divided into a series of segments. The purpose of this process was to identify and define sections of the watercourse that were internally homogenous and consisted of characteristic habitat types in relation to the other segments. This was done by examining the physical characteristics of the river to identify river sections which exhibit relatively uniform habitat types. The criteria employed in the segmentation process were flow regime, physiographic characteristics of the river basin, and channel morphology and pattern (Bovee 1982). The morphological factors that were considered when establishing segment boundaries included gradient, sediment supply, bank material, channel pattern and river valley characteristics. Segment boundaries were placed where significant changes occurred in one or more of these features. Segment boundaries were also established wherever a significant (≥10%) change in flow regime occurred or where a barrier to fish passage existed that could potentially affect fish distribution.

Within each river segment a single representative study area (termed a study reach) was established, consisting of a length of river 800 to 1 000 m in length. The study reach was selected to be representative of the characteristic habitat types present in the corresponding river segment. The study reach is the location within each river segment where detailed measurements of microhabitat characteristics are conducted at various flow rates to provide input for the simulation models.

Four river segments were tentatively identified within the Red Deer River Study Area by Fisheries Management Division. Segment boundaries were initially established after examination of 1:250 000 and 1:50 000 scale National Topographic System (NTS) maps. These tentative segment boundaries required confirmation through field examination and consultation with the regional Fisheries Management personnel in the City of Red Deer.

A helicopter overflight of the Red Deer River Study Area was conducted jointly by Fisheries Management Division and Golder personnel. During this flight, the four river segments within the study area and the segment boundaries were confirmed. In addition, several candidate study reaches were identified for each river segment, based on their physical habitat features and access considerations. Final selection of one representative study reach for each segment was conducted in the field during ground surveys, over the period 1-2 August 1991. The final segment boundaries and study reach locations are presented in Table 1, and are illustrated in Figure 2. As per convention, the river segments were numbered sequentially beginning with the downstream-most segment. The study reaches are numbered according to the segment in which they occur. The two uppermost segments (including Reaches 4 and 3) were in the parkland region of Alberta, whereas the third segment (including Reach 2) was transitional and the lowermost segment (including Reach 1) was in Alberta's prairie region.

3.2 Collection of Hydraulic Data

The representative study reaches were delineated by establishing permanent transects across the river channel. The study reach boundaries are defined by the upstream-most and downstream-most transects. In order to allow for proper calibration of the hydraulic simulation models, each study reach was defined by a hydraulic control at the downstream end of the study site, through which a transect was placed. Transects were also established across each hydraulic control within the study reach, as well as through all habitat types present (i.e., pool, riffle, run). Transects were also established through the transition zones between habitat types. Transects were marked with permanent headpins consisting of 0.5-m lengths of 13-mm rebar placed at the endpoints of each transect. The location of each headpin was marked with a 0.4-m long, 5-cm square wooden stake, painted blaze orange and marked with the appropriate transect number.

The relative elevations of the permanent headpins were determined on the date of their placement. This was accomplished by surveying a level-loop closure (accuracy ±0.003 m) in relation to a permanent benchmark established for the study, using the technique of differential levelling (Bovee and Milhous 1978). A permanent benchmark was established at each study reach which consisted of a 15.2-cm spike driven into a landmark feature. Each benchmark was assigned an arbitrary elevation. A Nikon AE-5 automatic level and a 7.6-m telescoping survey rod were used for all surveying.

A schematic diagram was prepared for each of the study reaches illustrating the general river morphology, the placements of the transects, headpins, benchmarks, and any feature or landmark significant to their location.

The techniques employed for the collection of the hydraulic and habitat data at each transect followed the specifications for the use of the PHABSIM methodology (Bovee 1982). The data collected at each station (vertical) on each transect included water depth (streambed elevation at dry stations), mean water column velocity, and substrate and cover information. Stationing across each transect was established with the use of a tagline consisting of a 250-m length of 3.2-mm diameter steel cable, marked at 1-m intervals. The tagline, which was anchored on each bank between the respective headpins for the transect, was suspended above the water using a hand-operated winch. The zero mark on the tagline was situated over the headpin on the left downstream bank to allow the use of identical stationing during subsequent measurements.

Other information collected during flow measurements included the wetted-perimeter distances between adjacent transects and water-surface elevations at each transect endpoint. Water-surface elevations were determined in relation to transect headpin elevations. All information was recorded on data sheets specifically designed for recording IFIM information.

Hydraulic measurements were conducted according to the standards established by the former Instream Flow and Aquatics Group of the U.S. Fish and Wildlife Service (Bovee and Milhous 1978; Trihey and Wegner 1981). Depth and velocity measurements at transect stations which could be waded were collected using top-setting wading rods and Price 622 AA or Marsh McBirney M201 water velocity meters. All velocity meters were calibrated by the National Calibration Service of Environment Canada. At transect stations too deep to wade, depth and velocity measurements were conducted from a 3.0-m inflatable boat attached to the steel tagline. Depth measurements were made with a Model 3300 Type B-56 or Model 2700 Type A-55 winch equipped with a computing-type counter and a 22.7-kg weight. Velocity measurements were made with a Price 622 AA current meter suspended from a M-2 hanger incorporated into the weight suspension system.

Water Survey of Canada procedures were used to collect mean column velocity measurements (Terzi 1981). For depths less than 0.75 m, velocity measurements were conducted at 60% of the total depth, as measured from the surface. For depths equal to or greater than 0.75 m, velocity was measured at both 20% and 80% of depth; the average of the two measurements was recorded as the mean column velocity.

Substrate and cover information was recorded for all stations on each transect during the low-flow measurements. Substrate information was recorded for each station as percent composition according to the criteria presented in Table 2. Substrate composition was determined by visual estimation of the percent occurrence of each of the size classes and each of the size classes was assigned a substrate index value (Table 2). The average substrate index value for each station was calculated from the indices for the size classes present using a weighted average, with the average weighted according to the percent occurrence of each size class. Data concerning the amount of available cover for each station were recorded by fish life stage (fry, juvenile, or adult) as percent availability and converted to the coding categories presented in Table 3; for an object to be considered as providing cover for a life stage, it had to be equal to or larger than the size of the fish for which the cover was being evaluated. Codes of 1, 2, 2.5, and 3 respectively represent cover < 10%, instream cover ≥ 10%, both cover types ≥ 10%, and overhead cover ≥ 10%, respectively, given that 10% cover often provides optimal habitat for non-spawning brown trout (Raleigh *et al.* 1986).

A metric staff gauge was placed in each study reach while hydraulic measurements were being conducted. The staff gauge reading was recorded at the start and finish of measurements for each transect to determine if a change in river stage occurred while the measurements were being made.

Hydraulic measurements were conducted at three selected flow rates to provide a suitable range of data for calibration of the hydraulic models. Measurements of depths, velocities, substrate types, and cover availability were recorded across each transect during a low river stage, as were water surface elevations at water's edge on each transect. Measurements of depth, velocity and water-surface elevations were also recorded at the same stations during a medium river stage. At a high river stage, water-surface elevations were again recorded at each transect and the river discharge rate was determined. This high-flow data were collected to provide additional information on the stage-discharge relationship for each transect. The hydraulic information was entered into a hydraulic simulation program, and the data decks were calibrated, providing for the definition of the distributions of depth, velocity, substrate, and cover at any flow within the range of discharges measured.

Low-flow measurements were conducted at each of the four study reaches during the period 7-10 October 1991. High-stage measurements were conducted the following year during the spring spate, with measurements occurring over the period 15-18 June, 1992. The medium flow data were collected over the period 21-26 June, 1992 as the river hydrograph declined following freshet.

A photographic record was taken at each study reach during each stage measurement to illustrate the appearance, morphology, and dynamics of the reach during the observed flow conditions.

3.3 Hydraulic Modelling

All modelling was done using the 1991 (version-II) release of the Physical Habitat Simulation System (PHABSIM) software on IBM-compatible personal computers (Milhous *et al.* 1989). Data decks were entered to conform to standard format metric data decks used in previous studies (Fernet *et al.* 1990). The current PHABSIM software has very limited support for metric data, so the data decks were converted to imperial units with a utility program developed for that purpose.

3.3.1 Data Deck Calibration

It was necessary to calibrate the data decks to accurately predict water surface elevations at a range of flows. This was done using several programs from the PHABSIM software. The programs chosen and the method of use varied with the specific nature of each transect.

A typical study reach began with a transect on a downstream control where the water-surface elevation at a given discharge was controlled by the shape of the channel and the roughness of the substrate. Control transects are generally shallow, fast flowing portions of the river. Upstream of the control, some transects were located through transition areas and pools. The water surface elevation (WSEL) of these transects is dictated by the downstream control. Pools are typically deeper and slower than controls. Finally, there were generally some transects through runs. The characteristics across these transects are similar to those of controls in terms of depth and velocity, but these habitat types may not exert any control over the stage of transects upstream of them. WSEL at a given discharge is controlled by streambed shape and substrate type.

Thus, there are two typical types of transects in an IFIM Study Reach; those where WSEL is controlled by streambed characteristics and those where WSEL is controlled by downstream controls. These two types of transects require different modelling techniques for proper calibration of the hydraulic data deck.

The calibration process begins with the IFG4 data deck. The IFG4 model is used to determine both WSELs and velocities for the discharges to be simulated. IFG4 uses the stage-discharge relationship to calculate WSEL (stage) for each simulated discharge. The results of the simulation are checked using utility programs. Typically, the IFG4 model simulates WSELs well in the range of measured stage-discharges. Outside of this range it is common to have IFG4 predict WSELs that are too high or too low compared to adjacent transects, because IFG4 simulates each transect independently.

WSELs for all transects in the model are checked to ensure that water levels decrease in the downstream direction (i.e., water always flows downhill). Modelling the highest and lowest discharges of interest will quickly reveal simulation errors; uncalibrated IFG4 data decks will often predict WSELs that increase as one proceeds downstream. Velocity should increase with discharge in most cases. Velocity adjustment factors (VAFs) must not, however, be too high. If the calculated stage is too high, VAFs often decrease with stage, whereas VAFs can be very large if the calculated stage is too low.

If IFG4 cannot simulate the stage-discharge relationship satisfactorily for all transects, problem transects must be modelled using MANSQ or WSP, whichever is appropriate. MANSQ is used for transects that are runs or controls. WSP is used for transects with backwater effects (e.g., pools). Typically, the calibration method involves using MANSQ to predict the control stage for each simulated discharge. The known stage-discharge relationship measured in the field is used to calibrate the MANSQ model. MANSQ then predicts WSELs outside of the known stage-discharge range.

The MANSQ results are then input into the WSP model. The most downstream transect in the WSP model always requires starting WSELs, supplied with MANSQ or a known relationship. The known stage-discharge relationship for the transects upstream of the control is then used to calibrate the WSP model. WSP is somewhat different from the IFG4 and MANSQ models in that it does not consider transects independently. WSP conserves energy and mass from transect to transect so each transect stage is influenced by the transect stage downstream of it. This allows WSP to work in pools where transect stage is not a function of transect channel properties.

The combined predictions of MANSQ and WSP provide the stage-discharge values for the IFG4 data decks. The resulting calibrated data deck is checked for VAFs and stage as during the initial evaluation. If necessary, adjustments are made to better calibrate the MANSQ and WSP decks and in turn modify the IFG4 data decks.

The final step is to check predicted velocities and roughness on a cell-by-cell basis. Edge cells typically have high calculated roughness due to low measured velocities. When such a deck is pushed to predict higher discharges, the IFG4 model gives all new wetted cells the same roughness. This can lead to underestimates of velocity for the newly wetted cells and higher velocities for the other cells. Reasonable values for roughness must be entered into the data deck for all cells above the highest cell with a measured velocity. It may also be necessary to modify cells with unreasonably high velocities. This is generally only a problem when modelling discharges greater than the one at which velocities were measured.

For extremely high discharges, the measured velocities are stripped from the data deck. Modelled velocities are then a function of depth. For example, the velocities measured at

120 m^3/s do not help predict velocities modelled at 800 m^3/s. In this instance, velocity based on depth is a better estimate of actual velocity for each cell.

The preceding is a brief description of the basic method of data-deck calibration for the use of IFIM models. In unusual cases, some departure from the approach outlined above is necessary. In these cases, the method is unique to the problem but typically involves the IFG4, MANSQ and WSP models.

3.3.2 Habitat Flow Relationship

Once the data decks are calibrated, IFG4 provides the depth, velocity, and either the substrate or cover for each cell in the study reach for each modelled discharge. The HABTAE program uses the habitat suitability curves for each life stage of each species of interest and interpolates a habitat suitability for each cell for each life stage and species. The area of the cell times the suitability index gives the Weighted Usable Area (WUA) for the cell. The sum of all the WUA's for all the cells at a discharge gives the WUA for the discharge. Modelling a range of discharges gives the WUA-discharge, or habitat-flow relationship.

3.3.3 Development of Fish Rule Curves

Fish Rule Curves (FRCs), or weekly streamflow recommendations for fish within each river reach, are developed by first identifying when each target life stage is present in the Red Deer River. A periodicity chart is prepared from this information, from which Biologically Significant Periods (BSPs) are identified (e.g., spring spawning period, summer rearing period, fall spawning period).

The habitat-flow relationships for all life stages present in each river segment during each BSP are examined, with emphasis on the most critical life stages present during that period. FRCs are developed by identifying flows which provide optimal, average, and estimated minimal acceptable habitat conditions from the habitat-flow relationship, which generally involves flows that protect 100, 50, and 20% of habitat for the target fish (Locke 1989, 1996; Fernet and Courtney 1991). Requests for these variable habitat conditions are based on water availability.

For example, optimal habitat conditions are requested during high flow years, while average habitat conditions are requested during average flow conditions. Minimal habitat conditions are requested during dry or drought years. Flow requests specified by Fish Rule Curves are adjusted such that they never exceed the amount of water present in the river.

Once FRCs are prepared for each weekly time step at each representative study site, the flow recommendations must be balanced for the river between Dickson Dam and the border so that requested flows do not decline in a downstream direction. If flow requests are increased in the downstream direction, tributary inflows must be present, of sufficient quantity to ensure requested flows are naturally present.

3.4 Collection and Analysis of Biological Information

To determine the instream flow needs of the four target management fish species, the habitat preferences of these species must be known for the Red Deer River. Habitat preference criteria were to be determined for all life stages (spawning, fry, juvenile, adult) of the four target management species: brown trout, mountain whitefish, walleye and goldeye. As site-specific habitat preference information was not available from the Red Deer River for any of these species, two approaches were employed to identify habitat preferences. For those life stages for which off-site habitat preference data were available from other Alberta watersheds, a transferability study was conducted to determine if this information was suitable for use in determining the habitat/flow relationships for these life stages in the Red Deer River. If the transferability study determined that the off-site habitat preference information was not suitable for use in the Red Deer River, then a full on-site habitat preference study was recommended. Off-site habitat preference information was available for all life stages of brown trout and mountain whitefish, and for the juvenile and adult life stages of walleye. For those species and life stages for which there was no existing habitat preference information, namely for walleye spawners and fry and all life stages of goldeye, complete habitat preference criteria studies were initiated in the Red Deer River.

To develop habitat preference information, it is necessary to determine both the microhabitat features being utilized by the life stage and the abundance of these microhabitat features at the time of the determination of habitat use. Where visibility permitted, habitat use data were collected by conducting observations of the target life stages in the Red Deer River. Where visibility did not permit diver observations, electrofishing was used to determine the location of the target species in the water column. For each observation of a target life stage, a marker was used to identify the position of the fish in the river. At each site, measurements of water depth and velocity were obtained and the substrate type and the presence or absence of each cover type was recorded. These measurements defined the specific microhabitat features utilized by the fish. The habitat use data were entered into a computer spreadsheet program and analyzed to produce frequency histograms for each variable and life stage.

In order to develop true habitat preferences, habitat availability at the time and location of the habitat use observations is required. If the habitat use observations were conducted within one of the designated IFIM study reaches, habitat availability was provided as output from the habitat simulation models. The PHABSIM group of models was used to model the habitat availability within the study reach at the discharge rate that was measured at the time of the fish observations. The availability information was also organized into frequency histograms using the same bin intervals as the habitat use data. If the habitat use observations were conducted outside of a designated study reach, habitat availability was determined through random measurements. With this process, a large number (minimum of three times the number of habitat use observations) of random habitat measurements were conducted at the same time as the habitat use observations. These measurements consisted of random point measurements of water depth, velocity, substrate type, and cover availability. These data were also organized into frequency histograms.

The habitat preference results were derived mathematically from the habitat use and habitat availability data using the formula:

$$P = U/A$$

where P represent habitat preference, U represents habitat use, and A represents habitat availability. To develop the habitat preference histograms, the frequency distributions of habitat use and habitat availability were normalized and the normalized habitat use histograms were divided by the normalized habitat availability histograms to produce the habitat preference histograms. This process corrects the habitat use information for any influences of habitat availability. The resultant habitat preference histograms were then normalized to produce the definitive habitat preference function for each life stage and variable.

For each life stage, the habitat preference is determined separately for each of the microhabitat variables measured. With the IFIM software, the habitat/flow relationship can only be developed for a maximum of three habitat variables for each life stage. One approach to the analysis is to choose three of the four measured habitat variables for each life stage to be included in the analysis. The three variables selected for the majority of the species and life stages were water depth, velocity, and substrate. The life stages analyzed in this manner included all life stages of mountain whitefish, walleye, and goldeye, as well as brown trout spawners. The exceptions were the fry, juvenile, and adult life stages of brown trout, for which cover was used instead of substrate; non-spawning brown trout show little preference for substrate types and are dependent on the presence of organic or boulder cover (Gosse and Helm 1982).

3.4.1 Transferability Studies

Existing off-site habitat preference criteria for all life stages of brown trout and mountain whitefish and the juvenile and adult life stages of walleye were tested for transferability to the Red Deer River. This off-site (source stream) information requires validation before it can be used to determine the habitat/flow relationships for these species in the Red Deer River (study stream). Validation of off-site criteria is achieved through a transferability analysis, which is an empirical test of the accuracy and reproducibility of the off-site habitat criteria within the study stream (Bovee 1986). Two types of transferability tests were conducted for the Red Deer River IFN study. The original transferability analysis consisted of an abbreviated convergence analysis and was conducted in 1992 using techniques developed for instream flow analysis (Bovee 1986; Kinzie and Ford 1988). The transferability data were re-tested in 1996 using revised techniques that, following the analysis in 1992, were recommended to replace the original analysis (Thomas and Bovee 1993; Bovee 1994). The results of both analyses are presented here.

The convergence analysis transferability test involved recording the depth, velocity, substrate, and cover use by a nominal number (25) of each life stage within one of the designated study reaches in the Red Deer River. This information was then used in conjunction with habitat availability information provided by PHABSIM analysis (see above and Appendix VI) to develop habitat preference histograms, which in this case are referred to as abbreviated histograms. The interval size for the frequency distribution bins for these histograms was determined from the bin intervals for the source stream criteria.

A comparison of the abbreviated habitat-preference histograms from the Red Deer River with those developed from the complete-criteria study in the source stream using goodness-of-fit statistics is impractical. The preference histograms for each of the individual habitat variables (depth, velocity, substrate, cover) calculated for a stream are dependent on the habitat availability in that stream, and habitat availability may not be comparable between the source and the study streams. The problem of having habitat availability as the denominator in calculating preference was alleviated by combining the habitat preference data from the source stream with the habitat availability data from the study stream to determine if the off-site preference criteria accurately predicts the pattern of habitat use that was observed in the study stream.

For each species and life stage included in the transferability study, the habitat-use histograms developed from the Red Deer River (actual use) were compared to a predicted-use curve produced for the Red Deer River from the off-site preference criteria, using the verification technique described by Kinzie and Ford (1988). This technique involved creating a predicted use distribution for the Red Deer River, using the availability distribution for the Red Deer River in combination with the preference distribution from the source stream.

For any given life stage, the preference function for the variable "i" is described by the relationship:

$$P^i = U^i/A^i$$

where P represents habitat preference, U represents habitat use and A corresponds to habitat availability. Therefore, the habitat use function is described by the following equation:

$$U^i = P^i \times A^i.$$

For each variable and life stage, the predicted habitat-use distribution for the Red Deer River study site (U^1) was calculated by multiplying the habitat preference distribution from the source stream (P^2) by the habitat availability from the Red Deer River study site (A^1) as follows:

$$U^1 = P^2 \times A^1.$$

The predicted use distribution was calculated so that it would have a total sample size equal to the number of observations (25) that was collected from the Red Deer River to determine the actual habitat use distribution for each life stage. Mathematically, this was done by multiplying each category of the predicted use function by the number:

$$N/Sum$$

where: N = the number of habitat use observations from the Red Deer River

Sum = the sum of all values in the categories of the predicted-use function

The predicted-use distribution could then be directly compared to the actual-use distribution for each of the habitat parameters for each of the life stages.

The predicted- and actual-use distributions were tested for significant differences using the Kolmogorov-Smirnov two-sample test for discrete data (Zar 1984), which is the recommended procedure to test for differences in the location, spread, or shape of two sets of suitability-index curve data (Slauson 1988). The predicted and observed habitat use for each species, life stage, and variable were compared by calculating cumulative frequencies for each of these two distributions. For each bin category, the cumulative frequency was calculated as the sum of all frequencies for that category and all preceding categories. For each category, the absolute difference between the two cumulative frequencies was then determined. The largest single difference between the two distributions was the test statistic and was compared to a critical value (p=0.05) derived from a statistical table. If the maximum difference was less than the critical value, the predicted use was not significantly different from the observed use, whereas if the maximum difference was greater than the critical value the difference between the predicted and observed use was considered to be significant.

If no significant difference existed between the predicted and observed use at the 95% confidence level, then the preference criteria from the source stream were considered to have accurately predicted the distribution of fish in the study stream. Such a result was interpreted to indicate that the preference criteria were transferable from the source stream to the study stream and were therefore suitable for determining the habitat-flow relationships in the Red Deer River. If the predicted and actual use distributions were determined to be significantly different, then the source stream preference criteria were not considered suitable for use in defining the habitat-flow relationships in the Red Deer River. If it was determined that the offstream habitat preference criteria for any given life stage(s) were not transferable, then a full criteria study was necessary for the Red Deer River for that particular life stage.

Due to budgetary considerations, and, for some species, low population levels in the Red Deer River, full criteria studies could not be completed for all life stages which failed the convergence analysis transferability test. Following the original analysis in 1992, the U.S. Instream Flow and Aquatics Group developed a new technique for testing the transferability of habitat suitability criteria (Bovee 1994), as it was believed that the convergence analysis technique has the potential to overemphasize the significance of rare habitat types (K. Bovee, pers. comm.). In addition, the abbreviated convergence analysis considers each of the microhabitat variables independently, which is considered a weakness of this technique. Therefore, for the life stages for which the off-site criteria failed the convergence analysis and for which full criteria studies were not conducted, the off-site criteria were re-tested for transferability using the Chi-Square test presented by Bovee and colleagues (Thomas and Bovee 1993; Bovee 1994).

For the new transferability test, each cell in the Red Deer River study reach where the observations were conducted was assigned a quality rating of optimal or usable, as well as suitable (optimal and usable combined) or unsuitable. The quality ratings were assigned for each species and life stage by applying the off-site habitat suitability criteria to the cells. A quality rating was assigned to each cell for each of the three habitat variables being considered on the following basis:

Source Stream Suitability	**Quality Rating**
> 0.80	Optimal
0.2 - 0.79	Usable
< 0.2	Unsuitable

For each cell, the overall quality rating was taken as the minimum rating of the three variables (Thomas and Bovee 1993). It was then determined which of the cells in the study reach were occupied by the target life stage and which were unoccupied. If the off-site criteria correctly describe the behaviour of the target life stage in the Red Deer River, two results are expected: 1) there should be proportionately more fish in optimal cells than in usable cells; and, 2) there should be proportionately more fish in suitable cells than in unsuitable cells.

A one-sided Chi-Square test was used to test for non-random selection of microhabitat conditions by the target life stage. Two tests were conducted, to compare the use of optimal versus usable cells, and, to compare the use of suitable versus unsuitable cells. The test statistic is given as:

$$T= \frac{[\sqrt{N}\,(ad-bc)]}{[(a+b)(c+d)(a+c)(b+d)]^{1/2}}$$

Where N = the total number of cells.

For the test of optimal versus usable cells,
a = the number of occupied optimal cells,
b = the number of occupied usable cells,
c = the number of unoccupied optimal cells, and
d = the number of unoccupied usable cells.

For the test of suitable versus unsuitable cells,
a = the number of occupied suitable cells,
b = the number of occupied unsuitable cells,
c = the number of unoccupied suitable cells, and
d = the number of unoccupied unsuitable cells.

For the off-site habitat suitability criteria to be considered transferable to the Red Deer River, the null hypotheses (H_{o1}: Optimal cells will be occupied in the same proportion as usable cells and, H_{o2}: suitable cells will be occupied in the same proportion as unsuitable cells) should be rejected at the 0.05 (95%) level of significance. Rejection of the null hypothesis at this significance level occurs if $T \geq 1.6449$.

Brown Trout

Habitat preference criteria were previously developed for all brown trout life stages from the Bow River (Fernet *et al.* 1990). In order to test the transferability of this data to the study area, habitat use and habitat preference information was collected for all four life stages from the Red Deer River. For the fry, juvenile, and adult life stages, habitat use was defined by conducting visual (snorkeling) observations of a minimum of 25 individuals per life stage in Study Reach 4, during the period 26 August-10 September 1991. Markers were placed in the stream at the locations where fish were observed and an underwater writing slate was used to record the marker number, fish life stage, and number of fish present. The microhabitat features were measured at each of these markers and attributed to the appropriate life stage. Habitat availability at the time of the observations was determined through the use of the hydraulic models, with the discharge at the time of the observations provided by the Dickson Dam Operations office.

For the spawning life stage, the stream was surveyed visually from a boat and while wading instream for the presence of spawning sites (redds). This survey was conducted over the period 4-6 November 1991. An insufficient number of spawning redds was located within Study Reach 4 to allow determination of habitat use. Therefore, the spawning survey was extended to include the portion of the Red Deer River below the Dickson Dam, downstream for the distance required to obtain the minimum number of observations. Habitat availability at the time of the spawning survey was determined through random measurements.

Mountain Whitefish

Existing habitat preference criteria are available for all life stages of mountain whitefish from the IFN study conducted for the Oldman River (Fernet and Matkowski 1986). As with brown trout, the transferability analysis of this habitat preference information was facilitated by conducting visual observations of the fry, juvenile and adult life stages in Study Reach 4 of the Red Deer River over the period 26-28 August 1991. Spawning mountain whitefish were also present in sufficient density to allow collection of the required number of observations within Reach 4. Spawning sites for mountain whitefish were identified by kick sampling for eggs in locations where electrofishing indicated spawning adults were congregating (Golder Associates Ltd. 1995). Habitat availability at the time of the observations was determined through the use of the hydraulic models and the discharge rate from the Dickson Dam.

Walleye

The off-site habitat preference information used in this study was developed for the juvenile and adult life stages of walleye from the Oldman River (Fernet *et al.* 1990). In order to test the transferability of this data to the study area, snorkel observations were conducted for these two life stages in Reach 4 of the Red Deer River over the period 26 August-6 September 1991. A minimum of 25 observations per life stage were used to define habitat use in the Red Deer River, and the hydraulic simulation models were used to provide habitat availability information.

3.4.2 Complete Habitat Preference Criteria Studies

Complete site-specific habitat preference criteria were developed for walleye spawners and fry and the fry, juvenile and adult life stages of goldeye. In addition, criteria studies were recommended for all species and life stages for which the available off-site preference criteria failed the transferability test. A complete criteria study involves determining the habitat preferences for specific life stages of the target species within the study stream. According to IFIM procedures (Bovee 1986), a minimum of 150 observations of habitat use for each life stage is recommended.

The habitat preference criteria were determined from the observation and availability data as described previously (Section 3.4). For the complete criteria studies, interval size for the frequency distribution bins was derived from the habitat use data using Sturges Rule, as recommended by Cherlak and Garcia (1988).

The Sturges equation is:

$$C = R/(1+3.322(\log N))$$

where: C = the optimal interval of bin size
R = the range of values
N = the number of observations

In addition to the habitat preference calculations, the data collected for the criteria studies were analyzed using Bonferroni confidence intervals for habitat use (Neu *et al.* 1974; Byers *et al.* 1984). The Bonferroni analysis involves calculating simultaneous confidence intervals for each of the habitat use bins for each given life stage and variable. It is a statistical technique for analyzing habitat utilization -availability data which compares the observed frequency of use for each bin interval with the frequency of use that would be expected if habitat use were based entirely on availability.

For each habitat use frequency bin, the Bonferroni confidence interval was calculated at the 95% confidence level. Expected habitat use was then calculated by multiplying the proportion of the available habitat within each bin by the sample size (i.e., number of observations). If the expected habitat use falls outside the 95% confidence interval for the observed use, then the observed use was considered to be significantly different from the distribution that would be expected assuming frequency of use was based on chance rather than habitat selectivity (i.e., preference).

For each bin interval, if the expected use was lower than the 95% confidence interval for the observed use, the observed use was considered significantly higher, and it was concluded that there was a demonstrated preference for the bin interval value in relation to its availability.

Conversely, if the expected use was higher than the confidence interval for the observed use, the observed use was considered to be significantly lower, indicating no selectivity for the bin interval.

Walleye

Habitat preference data for walleye fry were collected during the period 12-24 September 1991, while habitat preference data for spawning walleye were collected the following spring, over the period 23-27 April 1992.

Previous to each of these data collection periods, an inventory was conducted in Segments 3 and 4 of the Red Deer River in an attempt to locate significant walleye spawning and nursery areas. This inventory was conducted in the mainstem, in order to find areas with large enough populations of walleye spawners and fry to provide a suitable number of habitat use observations to enable development of habitat preference information. The portions of the river that were examined were based on consultation with the Regional Fish and Wildlife office which was conducting a study of walleye spawning and nursery areas in this portion of the watershed. During the inventory portions of the habitat preference studies, no concentrations of adult walleye were observed and no spawning grounds were identified on the mainstem river. A few isolated walleye fry were observed in the mainstem river, but no significant nursery areas were recorded. Preliminary results from the Red Deer Fish and Wildlife office indicated that walleye from the mainstem river were utilizing the Medicine River for spawning activity, and that nursery areas were present in the Medicine River and in the mainstem Red Deer River in the vicinity of the Medicine River confluence. By extending inventory investigations into the lower portion of the Medicine River, both walleye spawning and rearing areas were located. As a result, the habitat preference criteria for spawning walleye and walleye fry for the Red Deer River were developed from the lower section of the Medicine River.

The waters of the Medicine River were much too turbid to conduct habitat use observations by the preferred technique of visual observation (i.e., snorkeling), so walleye fry were sampled by electrofishing. The equipment employed consisted of a Smith-Root 5.0 GPP portable boat electrofisher mounted in a 3.0-m inflatable boat which was propelled by a 35 hp outboard jet motor. For each walleye fry observed while electrofishing, a numbered marker was deployed to indicate the location. Measurement of microhabitat features (depth, velocity, substrate, and cover) was conducted at each marker. All available habitats in the lower portion of the Medicine River were sampled for the presence of walleye fry, and sampling continued until 150 habitat use observations had been obtained.

Spawning habitat utilization data for walleye were obtained in the Medicine River by sampling for the presence of walleye eggs in the locations where concentrations of adult walleye in spawning condition were recorded during the electrofishing inventory. Since flow conditions during the sampling period were low and water depths relatively shallow, sampling for incubating eggs was conducted by kick sampling. At each location where incubating eggs were recovered, the number of viable, fertilized eggs was recorded and measurements of microhabitat features were conducted. Sampling continued until 150 sites where one or more eggs were found had been measured.

For both the spawning and nursery study, habitat availability data were obtained by random measurements. A minimum of 450 random measurements of microhabitat features was obtained during each of the two study periods. During the spawning study, kick sampling was conducted at each of the random measurement stations to check for habitat use at these sites. A staff gauge was placed in the study area during each of the investigations to ensure that the river stage did not change during the measurement of the habitat use and availability data.

For the juvenile and adult life stages, the convergence analysis transferability test was completed upon calibration of the hydraulic data decks in 1992. It was determined that the off-site criteria for both of these life stages was not transferable to the Red Deer River. However, budgetary concerns did not allow conducting full preference criteria studies for these two life stages in 1993. It was decided to conduct a transferability test of the same off-site (Oldman River) preference criteria using habitat use observations from either Segment 1 or 2 of the study area. The rationale for this decision was based on the fact that the Oldman River criteria were developed from the vicinity of the Grand Forks, where conditions are quite turbid. The observations from Reach 4 of the Red Deer River were conducted in the clear water habitat below the Dickson Dam. As walleye is a light-sensitive species, it was believed that the relative difference in turbidity levels would be a factor in the selection of microhabitat features such as depth and cover and, therefore, the criteria from the Oldman River could be more suitable for use in the lower, more turbid segments of the Red Deer River.

Boat electrofishing investigations were conducted in Segments 1 and 2 on 23-24 August 1993 to locate juvenile and adult walleye. Very few walleye were observed in each of these two reaches, due to extremely turbid conditions and possibly due to low walleye abundance, and these investigations were discontinued. Attempts were also made to obtain walleye electrofishing observations from Segments 3 and 4 on the 7-8 September, but were discontinued for the same reasons.

In order to collect as much biological data within the available budget, it was decided to collect utilization data for adult and juvenile walleye by snorkeling in Segment 4, without analyzing this data to develop habitat preference information (i.e., to complete the analysis on the basis of habitat use alone). However, due to the turbid conditions that persisted over the summer of 1993, no observations could be conducted.

In 1994, budgets did not allow habitat preference studies for the walleye adult and juvenile life stages. In order to maximize the number of species and life stages that could be included in the habitat/flow relationships for the Red Deer River with the available budget, it was decided to collect habitat use data for adult walleye rather than to eliminate this life stage from consideration. The objective was to collect 150 habitat use observations. Information supplied by the Fish and Wildlife office in Red Deer concerning the location of radio-tagged adult walleye was to be used to assist in locating and observing the target life stage.

Investigations were conducted during the summer and fall of 1994 over the periods 9-12 August, 15-17 August, and 16 and 30 September. Locations of radio-tagged walleye, as supplied by Fisheries Management Division, were examined visually for the presence of adult fish. In addition, a Telonics TR-2 radiotelemetry receiver was used to locate radio-tagged fish for which the frequencies were compatible. During the investigations in August, a few observations were collected using the snorkeling technique but most fish were found to be in deep-water holding areas, deeper than surface snorkeling could effectively sample. Observations during September were attempted using SCUBA but proved unsuccessful due to high turbidity levels. As only a small number of observations were collected, habitat use criteria for adult walleye could not be determined.

Goldeye

Investigations of the habitat preferences of goldeye in the Red Deer River were initiated with an inventory to locate significant concentrations of each life stage. Information on the life history of this species in the Red Deer River is incomplete. Some of the existing information suggests that goldeye are primarily migratory, arriving in the upper and middle reaches of the Red Deer River in the spring and leaving for downstream areas (possibly the South Saskatchewan River) in the fall (Nelson and Paetz 1992). It was not known if the spring return of goldeye was a pre-spawning or a post-spawning movement. Initial inventory efforts were conducted in Study Reach 2 (Big Valley) in the early fall of 1991, during the period 24-25 September. Visual observations (snorkeling) and boat electrofishing were conducted but failed to locate any goldeye. As reports suggested that goldeye were abundant at this location in the summer, it was assumed that the fall movement was underway or complete.

Investigations continued the following spring to determine when goldeye arrived, where they were concentrated and their reproductive status. Boat electrofishing was conducted throughout river Segments 1 and 2, including the relevant IFIM study reaches, over the period 25 May - 2 June 1992. During the later part of May, goldeye were encountered in small numbers at various locations in Segments 1 and 2. During the first two days of June, a large concentration of adult goldeye was recorded in Study Reach 2 (Big Valley). It was determined that these fish were pre-spawning adults, with most of the females still containing their egg mass. Therefore, an investigation into the habitat preferences of spawning goldeye was conducted in Study Reach 2 over the period 3-8 June 1992.

There is no existing information concerning the habitat features preferred by spawning goldeye. The eggs are semi-buoyant (Scott and Crossman 1973), and therefore their location in the stream may not be a reliable indicator of the location of the spawning act. In addition, turbidity levels preclude use of visual observations to record spawning activity. It is also unknown if spawning activity takes place at night or during the day. As a result, a number of sampling techniques were employed in the attempt to identify the specific microhabitat features preferred by spawning goldeye.

Boat electrofishing was conducted using a Smith-Root SR-18 electrofishing unit throughout the study reach, both at night and during the day. This unit consists of an 18 foot aluminum river boat equipped with an integral 5.0 GPP electrofishing unit, forward work platform and live-well, powered by a 90 hp outboard jet motor. The work platform is equipped with a full bank of lights for night work. During electrofishing runs through the study reach, numbered markers were deployed at the locations where concentrations of adult goldeye were captured. The number of fish observed at each marker was recorded, as was the state of sexual maturity (i.e., green, ripe, spent) of the fish. Measurements were made of the microhabitat features at each marker.

Three techniques were utilized to collect goldeye eggs, including kick sampling, drift netting, and sieve netting. Kick sampling was conducted at locations where concentrations of adult goldeye were recorded to check for the presence of eggs. In the locations where eggs were recovered by kick sampling, the microhabitat features were measured. Drift nets were set in the shallows along each of the shorelines, with the intention of capturing drifting eggs to determine if the semi-buoyant eggs were drifting downstream. The drift nets sampled the entire water column from the river bed to the surface, with the drift net mouths being 0.9m x 0.9m wide. The sieve nets were dragged through the water throughout the study reach to check for the presence of drifting eggs near the surface.

Habitat preference data were collected for the other life stages of goldeye over the following periods in 1992: fry - 28-30 August; juvenile and adult - 13-18 August. Investigations of the habitat preferences of adults and juveniles were conducted in Study Reach 2 (Big Valley), while the fry study was conducted farther downstream in Study Reach 1 (Jenner). Due to the turbid conditions present in Reaches 1 and 2, habitat use observations were obtained by boat electrofishing. The SR-18 electrofishing unit was used to locate juvenile and adult goldeye in Reach 2. The portable boat electrofisher and inflatable boat were used to locate goldeye fry in Reach 1, as they were generally located in shallow backwaters along shore where it was difficult to operate the larger river boat. For each goldeye fry, juvenile, or adult observed while electrofishing, a numbered marker was deployed to indicate the location. Measurements of the microhabitat features were then conducted at each marker.

As both these studies took place within designated study reaches, habitat availability data for use in developing the habitat preference information were obtained from the hydraulic simulation models. The river discharge was measured at the time of the habitat use observations and the habitat availability at the measured discharge was calculated by the simulation models.

Mountain Whitefish

The transferability analysis for all mountain whitefish life stages was completed in 1992, after the hydraulic models were calibrated. It was determined that none of the off-site (Oldman River) preference criteria for any of the four life stages was suitable for use in developing the habitat/flow relationships for the Red Deer River[1]. Therefore, a study was initiated to conduct a complete on-site habitat preference investigation for all life stages of mountain whitefish during the summer and fall of 1993. However, due to numerous prolonged rainfall events over the summer of 1993, the discharge and turbidity levels in Reach 4 remained too high to allow snorkeling observations. The only life stage for which habitat preference criteria could be developed in 1993 was the spawning life stage. A separate report has been prepared and submitted concerning habitat preference criteria of mountain whitefish spawners in the Red Deer River (Golder Associates Ltd. 1995); this information is also summarized in this report.

Collection of complete habitat preference criteria for spawning mountain whitefish was conducted over the period 25-28 October 1993. As during the transferability study and in the Oldman River criteria study, mountain whitefish spawning activity could not be observed. The recovery of incubating eggs from the substrate was used as an indicator of habitat use by spawning mountain whitefish.

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[1] Recent re-analysis of the mountain whitefish spawning data indicates that this life stage passed the transferability analysis (Appendix 3, Tables 22 - 24). However, while the transferability test for velocity passed statistically, a visual analysis of the graph (Figure 25) indicates that the fit is relatively poor. A full criteria study was carried out, the results of which were used in subsequent analyses.

A systematic approach was used to locate incubating eggs and to define habitat use within Study Reach 4. A series of transects was used to search the study reach, with transects being established across each habitat type present. Transects were also established in transition zones between habitat types. Along each transect, airlift sampling was used to sample for eggs. The airlift unit consisted of a gas-powered, 3.5-hp compressor attached by an air hose to a 15.2 cm diameter airlift head with collection bag. Regular stations were established every two or three metres along each transect from water's edge to water's edge. At each station with sufficient water depth, a standard five airlift samples were collected, each sample consisting of touching the airlift head to the substrate once. At the shallow stations along the shoreline, kick sampling was used to sample for the presence of eggs.

At each station where incubating eggs were collected, the number of viable eggs observed was recorded and the microhabitat features were measured. The microhabitat variables that were measured included water depth, velocity, and substrate. A minimum number of 150 stations with one or more eggs were measured. In producing the habitat use histograms, each observation was weighted according to the number of eggs present. This was done by determining the proportion of the total number of eggs recovered during the study that were collected at each individual site, and weighting the relevant microhabitat data for the site according to this proportion. Habitat availability histograms were produced from the output of the hydraulic simulation models, given the river discharge supplied by the Dickson Dam Operations office. From this information, the habitat preference histograms were produced.

In 1994, additional habitat preference data were collected for mountain whitefish. Budgetary constraints precluded collecting data for all three missing life stages and the 1994 program specified the determination of habitat preferences for the mountain whitefish adult life stage only.

Collection of complete habitat preference criteria for adult mountain whitefish in Study Reach 4 was conducted over the period 2-5 August, 1994. Habitat use data were collected by snorkeling and habitat availability was determined with the hydraulic models for Reach 4, using the discharge for the study period as supplied by the Dickson Dam Operations office.

4. RESULTS

4.1 Hydraulic Data

The dates on which measurements were conducted at the various Red Deer River study reaches, the type of measurements that were conducted, and the calculated discharge rates for these sampling dates are summarized in Table 4. The hydraulic data decks were calibrated using this data. Schematic diagrams of the four study reaches are presented in Appendix I and photographs of the study reaches at the various river stages are presented in Appendix II. The hydraulic data decks for the Red Deer River Study Reaches are presented in Appendix VII.

4.2 Biological Data

4.2.1 Transferability Studies

During the summer of 1991, habitat use data were collected from the Red Deer River to test the transferability of off-stream habitat preference criteria for the following species and life stages:

brown trout:	spawning, fry, juvenile, adult
mountain whitefish:	spawning, fry, juvenile, adult
walleye:	juvenile, adult

Following the calibration of the hydraulic data decks in 1992, which allowed for modelling of the habitat availability, the transferability analyses were completed.

The results of the abbreviated convergence analysis transferability test are presented graphically in Figures 3 through 32 and the tabulated data are presented in Appendix III. Each of these figures presents the results for a single habitat variable for a single species and life stage and consists of a series of three histograms. Presented on each figure are the histograms which represent the observed habitat use, the histograms representing habitat availability at the time of the observations, and the abbreviated habitat-preference histograms for the Red Deer River that were calculated as specified in Section 4.4. Superimposed over each of the preference histograms is the source stream (off-site) preference function, presented here as the suitability curve, which was tested for transferability to the Red Deer River. Superimposed over each of the habitat use histograms is the predicted habitat use curve which was calculated by multiplying the source stream suitability curve by the Red Deer River habitat availability histograms, as described in Section 4.4.1.

Table 5 presents the results of the Kolmogorov-Smirnov statistical test for the abbreviated convergence analysis. The test employed here is goodness-of-fit for discrete data, for use with data in ordered categories. For each life stage and variable for which there was a statistically significant difference between the observed habitat use and the predicted habitat use, the transferability test result is a fail. This result means that for this particular life stage and variable the off-site preference criteria is not suitable for use in the Red Deer River. Conversely, a pass result on Table 5 indicates that the habitat use predicted for the Red Deer River by the off-site criteria was not significantly different from the habitat use actually observed. This result indicates that the off-site criteria for the given life stage and variable is suitable for use in developing the habitat/flow relationship in the Red Deer River.

The results of the convergence transferability tests (Table 5) determined that the off-site criteria for all of the tested species/life stages were not transferable to the Red Deer River. There were no life stages where all of the habitat variables (i.e., depth, velocity, substrate or cover) were found to be transferable, although for some life stages some of the habitat variables were transferable (usually variables besides depth). These results indicated it would be necessary to develop on-site habitat preference criteria from the Red Deer River for each of these species and life stages.

Results of the alternate transferability test that was developed at a later date to replace the abbreviated convergence analysis are presented in Table 6. Table 6 presents the results of the Chi-Square test of optimal versus usable cells and suitable versus unsuitable cells. All test results ≥ 1.6449 indicate that the source stream habitat suitability criteria are transferable to the Red Deer River and, therefore, are suitable for developing the habitat/flow relationship. Results of the newer transferability test presented in Table 6, if different from Table 5, are considered definitive.

The results presented in Table 6 indicate that, for all of the target species and life stages except juvenile mountain whitefish, the off-site criteria would be considered transferable to the Red Deer River. For brown trout fry, mountain whitefish fry and juvenile walleye, the test comparing the use of optimal versus usable cells did not provide a result (Table 6). This is because the denominator of the equation used to calculate the test statistic was zero, which occurred because all of the optimal and usable cells were occupied, leaving zero unoccupied optimal/usable cells. In this case the equation cannot provide a result. However, since all available optimal and usable cells were occupied, this result is considered to represent the best possible fit of the data and is considered a validation of the off-site criteria.

For juvenile mountain whitefish, the failure of the off-site criteria in the transferability test is due to the failure of this criteria to describe optimal versus usable habitat. The criteria was very successful at describing suitable versus unsuitable habitat in the Red Deer River, as evidenced by the relatively high T value for the suitable versus unsuitable test (Table 6). Failure to describe suitable versus unsuitable habitat in this transferability assessment indicates that the criteria were flawed, whereas failure of the criteria to transfer as a result of the test of optimal versus usable habitat alone suggests that the optimal range is positioned incorrectly, being too narrow or too broad (Groshens and Orth 1993; Thomas and Bovee 1993). Perhaps only slight modifications of the suitability criteria are required to successfully predict habitat use in the Red Deer River.

Groshens and Orth (1993) found that combining suitability criteria from multiple sources to produce general criteria improved the transferability of the criteria, and that general criteria produced from data which failed only the optimal-versus-usable test transferred well between streams. Such generalized curves were produced for certain life stages of brown trout, mountain whitefish, and walleye by modifying the off-site criteria to include habitat preference information from other data collected in the South Saskatchewan River drainage (Table 7); enveloping was used to avoid irregularities (polymodal behaviour) in the habitat suitability curves (Bovee 1986). Such combining of data broadened the peaks of the habitat suitability curves, which would be expected to result from increases in sample size. In addition, because conspecific fish within the same river drainage should be similar in genetic composition, it is assumed that individual fish species have some ability to adjust to habitat modifications (further justifying use of composite curves).

Because several data sets were used for fry and juvenile mountain whitefish, the habitat suitability criteria for these life stages were re-tested for transferability to the Red Deer River using the Chi-Square test discussed above. Both life stages passed the two tests (Table 6), indicating the criteria were transferable. All curves developed for the study were then subjected to a review at a workshop held in February, 1998 for that purpose, which was attended by Golder and Fisheries Management Division personnel. At that workshop, the final curves used in the analysis were developed by consensus. The final habitat preference curves are presented in Figures 54 through 57.

4.2.2 Full Criteria Studies

Complete on-site habitat preference studies were conducted in the Red Deer River for the following species and life stages:

mountain whitefish:	adult, spawning
walleye:	fry, spawning
goldeye:	fry, juvenile, adult

The resultant habitat preference information is presented separately for each species and life stage, by habitat variable on Figures 33 through 53 and in Appendix IV. For each life stage, the habitat preference information is presented on one figure as three functions. The first set of histograms represents habitat use, the second represents habitat availability, and the third set of histograms represents the habitat preference function. A solid line has been superimposed over the habitat preference histograms which represents the best fit curve and is termed the suitability curve.

For all four mountain whitefish life stages, the off-site habitat preference criteria tested for transferability to the Red Deer River failed the transferability test. Habitat preference criteria were subsequently developed for the Red Deer River for the adult and spawning life stages of mountain whitefish only (Figures 33 to 38). Due to budgetary constraints, data for the development of preference criteria for the fry and juvenile life stages were not collected.

Off-site habitat preference data for all four life stages of brown trout also failed the transferability test. However, due to very small numbers of brown trout in the study area and budgetary considerations, habitat preference data were not collected for any of the brown trout life stages.

The lower section of the Medicine River was the most suitable location in the basin for obtaining the required number of observations for the walleye spawning and fry life stages. The habitat preference criteria for Red Deer River walleye for the spawning and fry life stages have been developed from the Medicine River (Figures 39 to 44).

Off-site preference criteria for juvenile and adult walleye failed the transferability test. Attempts to collect habitat use information for these two life stages from the Red Deer River were not successful.

Habitat preference information has been developed for the fry, juvenile and adult life stages for goldeye (Figures 45 to 53). Although a study was also conducted for the goldeye spawning life stage, the habitat preference criteria could not be defined as it was not possible to observe spawning behaviour in the turbid waters inhabited by goldeye. The semi-buoyant eggs of this species were collected from a variety of habitat types and it was considered that the presence of eggs was not a reliable indication that the site was specifically a spawning site.

4.2.3 Comparison to Out-of-Province Habitat-Suitability Models

Because fish often show different habitat-use patterns across rivers and regions, use of site-specific habitat suitability models minimizes the potential for inaccuracy in setting instream flow criteria (Waite and Barnhart 1992). On the other hand, use of generalized habitat suitability models such as those developed by the U.S. Fish and Wildlife Service (USFWS) can save time and money needed for instream flow studies. Such USFWS models have been developed for walleye (McMahon *et al.* 1984) and brown trout (Raleigh *et al.* 1986), whereas Northcote and Ennis (1994) reviewed habitat data for mountain whitefish.

Habitat utilization models developed for walleye in the Missouri River (McMahon *et al.* 1984) often diverged from our South Saskatchewan River models (Figures 39-44 and 57). Optimal (suitability index ≥ 0.8) depth use for the Missouri River fish were 0.4-1.7, 0.8-2.3, ≥ 1.1, and 0.7-1.65 m for fry, juveniles, adults, and spawners, respectively, similar to South Saskatchewan River curves although Missouri River fish sometimes showed broader depth use. Missouri River data showed that optimal average velocity use for non-spawning fish was ≤ 0.1 m/s, whereas South Saskatchewan River fish preferred a higher and broader range of velocities. On the other hand, Missouri River spawners showed optimal velocity use for 0.7-1.0 m/s, which was faster than velocities preferred by South Saskatchewan River fish. Substrate use for fry was ranged from inorganic fines to (1) gravel (Missouri River) or (2) large cobble (South Saskatchewan River), juveniles used mostly inorganic fines (Missouri River) or were generalized (South Saskatchewan River), adults showed highest use for inorganic fines to cobble (Missouri River) or preferred sand and larger substrates (South Saskatchewan River), and spawners used primarily gravel-cobble substrates (Missouri River) or preferred large gravel to small boulder (South Saskatchewan River). In summary, South Saskatchewan River fish used a broader range of substrates because of their preference for coarser substrates than were used by Missouri River fish.

Habitat utilization criteria developed for brown trout in the U.S. (Raleigh *et al.* 1986) also showed divergence from the South Saskatchewan River models (Figures 54-55). Optimal depth use for the U.S. fish were 0.3-0.7, 0.25-1.05, 0.3-1.1, and ≥ 0.2 m for fry, juveniles, adults, and spawners, respectively, either narrower or wider than depth use in South Saskatchewan River. U.S. data showed that optimal average velocity use for non-spawning fish was 0.1-0.3, 0.02-0.4, 0.03-0.4, and 0.2-0.65 m/s whereas South Saskatchewan River fish preferred higher velocities. U.S. spawners especially used small gravel to small cobble, somewhat broader than the preference of South Saskatchewan River fish for medium and large gravels.

Mountain whitefish habitat use data summarized for northwestern North America (Northcote and Ennis 1994) often diverged from the South Saskatchewan River models (Figures 33-38 and 56). Total depth use for the North America fish were 0.05-0.2, ≥ 0.9, and 0.1-1.2 m for fry, adults, and spawners, respectively, which is shallower usage than seen in the South Saskatchewan River. North American adults used a mean velocity of 0.13 m/s, much less than was observed in the

South Saskatchewan River. Substrate use for North American fry involved fines and gravel, whereas South Saskatchewan River fry and juveniles preferred sand to small boulder. North American adults used moderately fine substrates (i.e., only 7.5% boulder), not inconsistent with the preference of South Saskatchewan River fish for large gravel. North American spawners used gravel-cobble substrates, particularly large gravel and small cobble, similar to substrate use in the South Saskatchewan River; spawners preferred small cobble but also used small and large gravels.

In summary, the comparisons emphasize the importance of developing site- or region-specific habitat-suitability curves; differences in habitat availability and/or fish genetics across regions apparently contributed to divergence in habitat use.

In addition, the habitat preference models for walleye, brown trout, mountain whitefish, and goldeye in the South Saskatchewan River show evidence of ontogenetic changes, in that older life stages (adults and spawners) generally used deeper and faster habitats and coarser substrates than did fry and juveniles (Figures 33-57). The most notable exception to this trend was the similar depth use shown by different life stages of goldeye.

Given the variability of apparent habitat preferences, all habitat preference criteria used in the analysis were discussed in detail at the previously described workshop held in February 1998. Specifically, the workshop was attended by Allan Locke, Dave Christiansen and Vance Buchwald of Fisheries Management Division, and Dave Fernet of Golder Associates. At that workshop, the habitat preference criteria developed for the Red Deer River, the South Saskatchewan River drainage, as well as other areas of North America were compared and contrasted. The information from other areas of North America were collected from the Instream Flow Working Group library in Fort Collins, as well as in the case of brown trout, from the publication by Raleigh et al. (1986). To facilitate the process, these curves were copied onto overheads, and projected onto a screen. Each of the curves was considered separately, and consensus was reached on each habitat preference curve for each of the life stages of each of the target management species. The final habitat preference curves are presented as Figures 58 through 72. The coordinates for these curves are presented in Appendix VI.

4.3 Habitat-Flow Relationships

The habitat-flow relationships for the Red Deer River were developed for 4 fish species and 15 life stages. The life stages include fry, juveniles, and adults for goldeye, walleye, brown trout, and mountain whitefish, as well as spawning for the latter three species (see Table 8). The habitat-flow relationships, for each of the river segments in which the species have been targeted for management, are illustrated in Figures 73 through 77 for normally occurring flows and in Appendix V for all simulated flows.

4.4 Development of Fish Rule Curves

Fish Rule Curves (FRCs) were developed through the use of a composite habitat index (Locke 1989). This was accomplished by normalizing the habitat-flow relationships for the life stages of each species present in each BSP (Table 8), in each river reach. All normalized habitat-flow relationships were then plotted on a single graph, and the habitat-flow relationship for the composite habitat index was defined by the minimum relationship created by the composite of all habitat-flow relationships, and normalizing this relationship.

For each BSP, the FRC is defined by identifying the flow at which optimal habitat is provided for the composite habitat index, and assigning this flow to wet years (i.e., the 0 to 20 flow exceedence range). The flow at which average habitat (habitat suitability of 0.5) is provided is then identified, and this flow is assigned a 50% exceedence value. The flow that is associated with an 80% reduction in habitat is then identified, and this flow is assigned an 80 through 100 flow exceedence range. These points on the graph are then joined, to provide a draft of the FRC for that river reach and BSP.

The next step is a comparison of the resultant FRC with the individual habitat-flow relationships of each life stage of each species present in the BSP, to ensure the FRC developed for the composite habitat index does accommodate each life stage present. The FRCs may be revised as a result of this review, if it is apparent that unsuitable conditions would result for any individual life stage. The FRC is then superimposed on the natural flow exceedences for the river reach, on a weekly time step, and if the FRC exceeds the natural flows, the FRC is then reduced to match the natural flow exceedence. This step results in the preparation of an ideal FRC for each week during the open-water season for each reach. These ideal FRCs are presented on Table 9.

The FRCs developed for each river reach are then compared, to ensure flow requests from one reach to the next are the same or greater. If a flow request for a downstream reach is less than that of an upstream reach, the requested flow from the downstream reach is raised to match that of the upstream reach. If a critical or very important reach is present, flow requests are balanced around that reach. No critical or exceptionally important reach was identified in the section of the Red Deer River under consideration. The balanced FRCs for the Red Deer River are presented on Table 10.

5. DISCUSSION

The results of the biological investigations, together with concurrent studies being conducted by Fisheries Management Division, have provided insight into fish population dynamics in the Red Deer River subsequent to closure of the Dickson Dam in 1983. Examples of these findings include minimal spawning use by brown trout downstream of the dam, and virtually no walleye spawning in the Red Deer River in Reaches 3 and 4, despite physical habitat being available for this life stage (Figures 61 and 64, and Appendix V). However, there was high walleye fry use of the Red Deer River downstream of the Medicine River confluence in Reach 3.

Goldeye spawning and fry rearing were documented in the lower Red Deer River for the first time as a result of this study. Goldeye eggs were found in a variety of habitats because of the semi-pelagic nature of the eggs, making development of habitat suitability criteria for spawners impossible. Habitat preference criteria were developed for other goldeye life stages, providing information for considering habitat requirements of this important sport species in southern Alberta.

The reader should bear in mind that the Fish Rule Curves that are presented here address the issue of the amount of physical habitat required for the protection of the fishery resource. These Fish Rule Curves do not address several key issues in terms of ecosystem well-being. Other considerations include the requirement for flushing flows, the effects of discharge on water temperature and water quality, the flows required for channel maintenance (i.e., channel-forming flows), as well as issues such as flow requirements for fish migration. All of these issues need to be considered when developing the overall instream flow needs of rivers such as the Red Deer.

6. CLOSURE

We trust that this report presents the information that you require. Should any portion of the report require clarification, please do not hesitate to contact the undersigned.

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TABLE 1

RIVER SEGMENT BOUNDARIES AND STUDY REACH LOCATIONS, RED DEER RIVER STUDY AREA

River Segment	Segment Boundaries	General Characteristics	Segment Length (km)	Representative Study Reach Title/Location	
1	Alberta/Saskatchewan Border upstream to the City of Drumheller	Generally open river valley. River with low gradient, infrequent hydraulic controls and fairly uniform channel cross-section. High turbidity levels, substrate dominated by fines, sand bars common at low stage.	286	Jenner -	Located immediately downstream of Highway 884 crossing
2	Drumheller upstream to the Blindman River Confluence	River enters deeply incised valley at upstream origin of segment. Single, wide channel with uniform width and pattern, progressing from bedrock control and boulder substrate at upstream origin to sand substrate and minor gradient at downstream end.	183	Big Valley -	Located west of Big Valley, downstream of Highway 590
3	Blindman River Confluence upstream to the Medicine River Confluence	Primarily single channel but with several major side channels with permanent vegetated islands. Gravel/silt substrate, few gravel bars.	56	Red Deer -	Located at the Fort Normandeau Historic site upstream of the City of Red Deer
4	Medicine River Confluence upstream to the Dickson Dam	Generally a single channel, some braiding and side channels, gravel/cobble substrate, gravel bars common.	13	Dickson Dam -	Located approximately 2 km downstream of the Dam

TABLE 2

SUBSTRATE DEFINITIONS, CODES, AND SIZE-RANGE CATEGORIES

CLASS NAME	INDEX CODE	SIZE RANGE	
		mm	inches
Organic material[1]	0	-	-
Clay/Silt	1	<0.062	<0.0024
Sand	2	0.062-2.0	0.0024-0.08
Small Gravel	3	2-8	0.08-0.3
Medium Gravel	4	8-32	0.3-1.3
Large Gravel	5	32-64	1.3-2.5
Small Cobble	6	64-128	2.5-5
Large Cobble	7	128-256	5-10
Small Boulder	8	256-762	10-30
Large Boulder	9	>762	>30
Bedrock	10	-	-

[1] Includes organic detritus, vascular plants, and attached algae (Fernet and Walder 1986). Although absent from the Red Deer River, organic material was found in other parts of the South Saskatchewan River drainage and was thus a component of source habitat suitability models.

TABLE 3

COVER-TYPE CODES, DEFINITIONS, AND FUNCTIONS

CODE	TYPE	FUNCTION	EXAMPLES
1	No cover	No cover	No cover
2	Instream object	Velocity shelter	Substrate, boulders, partially buried logs, bedrock ledges, debris
3	Instream/offstream overhead cover	Direct/indirect visual isolation	Undercut bank, log jams, ledges, boulders, overhanging canopy

TABLE 4

SUMMARY OF HYDRAULIC MEASUREMENTS, RED DEER RIVER STUDY AREA, 1991 AND 1992

STUDY REACH	DATE	MEASUREMENT TYPE	DISCHARGE (m^3/s)
1	Oct. 10, 1991	- complete survey, depth/velocity/cover/substratedistribution - water surface elevations	34.6
	June 18, 1992	- single discharge transect - water surface elevations	268.6
	June 25, 1992	- complete survey, depth/velocity/coverdistribution - water surface elevations	110.4
2	Oct. 9, 1991	- complete survey, depth/velocity/cover/substratedistribution - water surface elevations	20.3
	June 17, 1992	- single discharge transect - water surface elevations	277.5
	June 24, 1992	- complete survey, depth/velocity/coverdistribution - water surface elevations	98.7
3	Oct. 8, 1991	- complete survey, depth/velocity/cover/substratedistribution - water surface elevations	19.4
	June 16, 1992	- single discharge transect - water surface elevations	293.6
	June 22, 1992	- complete survey, depth/velocity/coverdistribution - water surface elevations	89.7
4	Oct. 7, 1991	- complete survey, depth/velocity/cover/substratedistribution - water surface elevations	19.0
	June 15, 1992	- single discharge transect - water surface elevations	194.1
	June 21, 1992	- complete survey, depth/velocity/coverdistribution - water surface elevations	70.7

TABLE 5

RESULTS OF THE KOLMOGOROV-SMIRNOV ANALYSIS TO TEST THE TRANSFERABILITY OF OFF-SITE HABITAT PREFERENCE CRITERIA TO THE RED DEER RIVER

TARGET SPECIES	SOURCE STREAM FOR OFF-SITE CRITERIA	TARGET LIFE STAGE	MICROHABITAT VARIABLE			
			Depth	Velocity	Substrate	Cover
Brown Trout	Bow River[1]	Adult	Fail	Pass	-	Pass
		Juvenile	Fail	Pass	-	Pass
		Fry	Fail	Pass	-	Pass
		Spawning	Pass	Pass	Fail	-
Mountain Whitefish	Oldman River[2]	Adult	Fail	Pass	Pass	-
		Juvenile	Fail	Fail	Pass	-
		Fry	Fail	Pass	Fail	-
		Spawning	Pass	Pass	Pass	-
Walleye	Oldman River[1]	Adult	Fail	Fail	Pass	-
		Juvenile	Fail	Fail	Pass	-

[1] Fernet *et al.* 1990
[2] Fernet and Matkowski 1986

TABLE 6

RESULTS OF THE CHI-SQUARE ANALYSIS TO TEST THE TRANSFERABILITY OF OFF-SITE HABITAT PREFERENCE CRITERIA TO THE RED DEER RIVER

TARGET SPECIES	TARGET LIFE STAGE	RESULT		
		Optimal versus Useable	**Suitable versus Unsuitable**	**Overall (P=0.05)**
Brown Trout	Adult	3.3993	5.5088	Pass
	Juvenile	5.1583	4.5170	Pass
	Fry	NR[1]	3.4529	Pass
	Spawning	2.2550	4.1809	Pass
Mountain[2] Whitefish	Juvenile	1.6125	5.9605	Fail
	Fry	NR	5.8383	Pass
Mountain[3] Whitefish	Juvenile	4.7103	4.1451	Pass
	Fry	4.6766	6.0676	Pass
Walleye	Adult	1.6891	9.7792	Pass
	Juvenile	NR	10.6899	Pass

[1] NR = no result (test undefined because of division by 0)
[2] Oldman River criteria
[3] South Saskatchewan River drainage criteria (see Table 7)

TABLE 7

DATA SOURCES USED TO GENERATE GENERALIZED HSI CURVES, BASED ON RESEARCH IN THE SOUTH SASKATCHEWAN RIVER DRAINAGE

FISH SPECIES	RIVERS	REFERENCE(S)
Brown trout, 4 life stages	Bow & Red Deer	Present study
Mountain whitefish, 2 life stages	Oldman, Highwood, & Red Deer	Fernet (1983), Locke (1989), present study
Walleye, 2 life stages	Oldman & Red Deer	Present study

TABLE 8

FISH LIFE STAGES FOR EACH BIOLOGICALLY SIGNIFICANT PERIOD (BSP) IN THE RED DEER RIVER

REACH	DATE (JULIAN WEEK)	BSP	BROWN TROUT				MOUNTAIN WHITEFISH				WALLEYE				GOLDEYE		
			F	J	A	S	F	J	A	S	F	J	A	S	F	J	A
1&2	2 April-15 April (14-15)	1	.	.	.	.	.	.	.	.	.	X	X	.	.	X	X
	16 April-15 July (16-28)	2	.	.	.	.	.	.	.	.	.	X	.	X	.	X	X
	16 July-4 November (29-48)	3	.	.	.	.	.	.	.	.	X	X	X	.	X	X	X
3	2 April-1 July (14-26)	1	.	X	X	.	X	X	X	.	.	X	X	.	.	.	.
	2 July-16 September (27-37)	2	.	X	X	.	X	X	X	.	X	X	X	.	.	.	.
	17 September-4 November (38-48)	3	.	X	.	.	X	X	.	X	X	X	X	.	.	.	.
4	2 April-16 September (14-37)	1	X	X	X	.	X	X	X	.	.	.	X	.	.	.	.
	17 September-4 November (38-48)	2	X	X	.	X	X	X	.	X	.	.	X	.	.	.	.

TABLE 9
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IDEAL FISH RULE CURVES
FOR THE RED DEER RIVER

	% exceedence	Apr. 2-8		Apr. 9-15		Apr. 16-22		Apr. 23-29		Apr. 30-May 6		May 7-13		May 14-20		May 21-27	
		NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																	
	10	236	34	303	34	331	71	223	71	201	71	176	71	163	71	170	71
	20	175	34	164	34	166	71	164	71	117	71	107	71	108	71	114	71
	30	92	28	119	28	131	60	118	60	98	60	87	60	85	60	98	60
	40	61	22	90	22	95	48	78	48	75	48	68	48	68	48	87	48
	50	53	16	74	16	67	36	63	36	55	36	56	36	63	36	76	36
	60	40	15	53	15	58	28	55	28	48	28	49	28	51	28	68	28
	70	26	14	44	14	43	20	44	20	35	20	42	20	45	20	56	20
	80	21	13	35	13	38	13	33	13	30	13	36	13	38	13	40	13
	90	13	13	20	13	29	13	25	13	23	13	27	13	32	13	33	13
Reach 2																	
	10	163	30	246	30	231	59	197	59	140	59	140	59	149	59	177	59
	20	98	30	108	30	138	59	119	59	96	59	116	59	102	59	122	59
	30	66	27	73	27	102	49	96	49	78	49	94	49	84	49	100	49
	40	41	23	68	23	61	40	62	40	66	40	67	40	75	40	86	40
	50	32	20	45	20	50	30	52	30	58	30	51	30	63	30	77	30
	60	24	18	38	18	42	25	42	25	47	25	48	25	57	25	67	25
	70	21	16	30	16	38	19	32	19	37	19	40	19	48	19	52	19
	80	17	14	26	14	32	14	27	14	28	14	34	14	37	14	44	14
	90	9	9	18	14	20	14	21	14	22	14	26	14	30	14	37	14
Reach 3																	
	10	152	40	184	40	168	40	135	40	125	40	122	40	136	40	155	40
	20	73	40	81	40	111	40	101	40	83	40	98	40	93	40	117	40
	30	45	33	53	33	83	33	73	33	67	33	79	33	78	33	96	33
	40	31	26	49	26	52	26	52	26	57	26	51	26	61	26	79	26
	50	24	19	44	19	42	19	47	19	49	19	44	19	57	19	69	19
	60	18	17	33	17	34	17	35	17	38	17	41	17	51	17	63	17
	70	16	15	23	15	29	15	28	15	32	15	35	15	44	15	52	15
	80	13	13	21	13	26	13	22	13	23	13	29	13	36	13	41	13
	90	9	9	13	13	17	13	18	13	20	13	24	13	28	13	32	13
Reach 4																	
	10	49	49	55	55	57	57	51	51	59	59	71	70	84	70	91	70
	20	30	30	34	34	38	38	44	44	45	45	54	54	61	61	84	70
	30	23	23	27	27	35	35	37	37	39	39	47	47	53	53	72	56
	40	19	19	24	24	28	28	30	30	36	36	39	39	45	43	62	43
	50	16	16	22	22	23	23	26	26	31	29	34	29	42	29	57	29
	60	15	15	20	20	21	21	22	22	28	24	30	24	39	24	50	24
	70	14	14	17	17	19	18	19	18	22	18	28	18	37	18	45	18
	80	11	11	15	13	17	13	17	13	19	13	22	13	32	13	41	13
	90	9	9	13	13	14	13	14	13	17	13	19	13	23	13	29	13

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% exceed-ence	May 28-Jun. 3		Jun. 4-10		Jun. 11-17		Jun. 18-24		Jun. 25- Jul. 1		Jul. 2-8		Jul. 9-15		Jul. 16-22	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																
10	192	71	228	71	216	71	260	71	250	71	249	71	226	34	177	34
20	139	71	150	71	186	71	186	71	172	71	189	71	159	34	121	34
30	106	60	126	60	148	60	145	60	146	60	148	60	129	27	108	27
40	97	48	110	48	127	48	119	48	121	48	129	48	116	20	90	20
50	81	36	93	36	112	36	106	36	106	36	113	36	89	13	83	13
60	76	28	78	28	100	28	94	28	82	28	88	28	83	13	70	13
70	68	20	71	20	87	20	82	20	71	20	67	20	69	13	63	13
80	52	13	60	13	68	13	61	13	64	13	56	13	48	13	49	13
90	35	13	44	13	46	13	51	13	53	13	42	13	40	13	36	13
Reach 2																
10	203	59	210	59	203	59	273	59	256	59	216	59	176	59	152	30
20	139	59	150	59	168	59	179	59	163	59	166	59	134	59	99	30
30	114	49	125	49	146	49	129	49	130	49	143	49	113	49	92	27
40	96	40	107	40	119	40	106	40	109	40	122	40	94	40	80	23
50	87	30	99	30	107	30	98	30	96	30	110	30	85	30	72	20
60	75	25	80	25	97	25	84	25	80	25	86	25	77	25	64	18
70	64	19	68	19	85	19	73	19	66	19	61	19	64	19	57	16
80	52	14	62	14	65	14	62	14	57	14	51	14	45	14	49	14
90	40	14	43	14	44	14	52	14	43	14	42	14	37	14	37	14
Reach 3																
10	184	40	198	40	199	40	260	40	278	40	205	40	155	40	142	40
20	125	40	146	40	162	40	160	40	149	40	157	40	122	40	94	40
30	107	33	116	33	142	33	121	33	128	33	133	33	105	33	85	33
40	91	26	102	26	113	26	103	26	106	26	115	26	88	26	74	26
50	86	19	97	19	99	19	98	19	92	19	95	19	78	19	67	19
60	71	17	75	17	94	17	75	17	79	17	81	17	72	17	61	17
70	57	15	68	15	82	15	70	15	62	15	60	15	60	15	54	15
80	48	13	55	13	63	13	60	13	52	13	50	13	43	13	44	13
90	37	13	43	13	43	13	51	13	41	13	39	13	34	13	35	13
Reach 4																
10	134	70	155	70	139	70	158	70	161	70	153	70	127	70	104	70
20	98	70	112	70	127	70	113	70	111	70	121	70	102	70	87	70
30	83	56	96	56	107	56	94	56	98	56	103	56	80	56	72	56
40	77	43	87	43	92	43	87	43	85	43	90	43	74	43	66	43
50	68	29	71	29	83	29	83	29	78	29	85	29	69	29	59	29
60	59	24	68	24	75	24	69	24	67	24	76	24	65	24	54	24
70	51	18	59	18	66	18	58	18	56	18	60	18	58	18	49	18
80	45	13	47	13	61	13	54	13	48	13	46	13	43	13	43	13
90	33	13	40	13	42	13	46	13	39	13	37	13	34	13	33	13

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% exceedence	Jul. 23-29		Jul. 30- Aug. 5		Aug. 6-12		Aug. 13-19		Aug. 20-26		Aug. 27- Sep. 2		Sep. 3-9		Sep. 10-16	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																
10	136	34	136	34	110	34	96	34	87	34	84	34	80	34	69	34
20	101	34	107	34	88	34	80	34	77	34	61	34	58	34	52	34
30	86	27	89	27	78	27	70	27	64	27	56	27	51	27	45	27
40	75	20	70	20	67	20	57	20	55	20	51	20	47	20	43	20
50	64	13	57	13	59	13	52	13	52	13	47	13	43	13	40	13
60	60	13	53	13	51	13	48	13	45	13	44	13	40	13	37	13
70	53	13	51	13	46	13	44	13	41	13	39	13	36	13	33	13
80	44	13	40	13	41	13	38	13	37	13	33	13	31	13	28	13
90	35	13	34	13	35	13	33	13	32	13	30	13	28	13	25	13
Reach 2																
10	122	30	123	30	99	30	86	30	72	30	79	30	70	30	70	30
20	96	30	92	30	80	30	71	30	62	30	62	30	53	30	47	30
30	80	27	70	27	73	27	58	27	54	27	52	27	43	27	42	27
40	67	23	64	23	60	23	51	23	50	23	45	23	41	23	38	23
50	61	20	55	20	50	20	46	20	43	20	43	20	38	20	36	20
60	57	18	50	18	46	18	43	18	39	18	37	18	35	18	33	18
70	52	16	47	16	43	16	41	16	36	16	34	16	30	16	30	16
80	42	14	44	14	38	14	36	14	33	14	30	14	27	14	25	14
90	32	14	36	14	36	14	30	14	29	14	27	14	26	14	24	14
Reach 3																
10	120	40	107	40	95	40	82	40	66	40	75	40	65	40	66	40
20	88	40	81	40	76	40	64	40	59	40	59	40	47	40	43	40
30	72	33	67	33	69	33	58	33	51	33	48	33	40	33	39	33
40	61	26	60	26	51	26	48	26	47	26	42	26	39	26	36	26
50	59	19	52	19	46	19	44	19	41	19	38	19	34	19	34	19
60	52	17	48	17	43	17	41	17	36	17	34	17	32	17	31	17
70	49	15	45	15	41	15	38	15	34	15	32	15	29	15	28	15
80	41	13	41	13	36	13	35	13	31	13	28	13	27	13	23	13
90	32	13	35	13	34	13	30	13	28	13	26	13	25	13	22	13
Reach 4																
10	98	70	88	70	78	70	73	70	60	60	57	57	48	48	52	52
20	76	70	69	69	69	69	57	57	51	51	50	50	42	42	38	38
30	70	56	59	56	56	56	52	52	46	46	43	43	36	36	36	36
40	59	43	54	43	50	43	44	43	43	43	39	39	34	34	33	33
50	53	29	50	29	43	29	41	29	39	29	36	29	33	29	30	29
60	50	24	46	24	41	24	39	24	36	24	34	24	31	24	28	24
70	47	18	43	18	39	18	37	18	35	18	31	18	28	18	26	18
80	39	13	40	13	36	13	33	13	30	13	28	13	26	13	23	13
90	30	13	34	13	30	13	28	13	28	13	26	13	24	13	21	13

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% exceed-ence	Sep. 17-23		Sep. 24-30		Oct. 1-7		Oct. 8-14		Oct. 15-21		Oct. 22-28		Oct. 29- Nov. 4	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1														
10	85	34	77	34	67	34	61	34	51	34	47	34	39	34
20	50	34	50	34	45	34	42	34	37	34	34	34	32	32
30	46	27	42	27	40	27	37	27	34	27	32	27	31	27
40	41	20	40	20	38	20	33	20	31	20	29	20	26	20
50	38	13	36	13	31	13	32	13	29	13	27	13	25	13
60	36	13	34	13	30	13	28	13	26	13	24	13	21	13
70	34	13	30	13	28	13	26	13	24	13	22	13	20	13
80	27	13	26	13	25	13	24	13	21	13	20	13	16	13
90	21	13	21	13	19	13	17	13	17	13	17	13	14	13
Reach 2														
10	68	30	69	30	54	30	54	30	46	30	37	30	31	30
20	44	30	43	30	42	30	36	30	32	30	30	30	27	27
30	38	27	36	27	37	27	32	27	29	27	27	27	25	25
40	36	23	32	23	32	23	29	23	28	23	24	23	23	23
50	33	20	31	20	27	20	25	20	24	20	22	20	20	20
60	31	18	26	18	25	18	22	18	22	18	20	18	17	17
70	27	16	25	16	23	16	21	16	20	16	18	16	16	16
80	23	14	21	14	21	14	19	14	18	14	17	14	14	14
90	20	14	20	14	18	14	17	14	16	14	15	14	12	12
Reach 3														
10	64	54	64	54	57	54	50	50	43	43	34	34	30	30
20	43	43	40	40	38	38	33	33	30	30	29	29	26	26
30	36	36	34	34	35	35	30	30	27	27	25	25	23	23
40	34	34	31	31	29	29	28	28	26	26	23	23	21	21
50	30	25	29	25	26	25	23	23	24	24	20	20	18	18
60	29	21	25	21	24	21	22	21	20	20	19	19	16	16
70	25	17	24	17	21	17	20	17	18	17	17	17	16	16
80	22	13	21	13	20	13	19	13	17	13	16	13	13	13
90	19	13	18	13	17	13	16	13	15	13	14	13	11	11
Reach 4														
10	47	47	44	44	40	40	36	36	31	31	26	26	23	23
20	38	38	32	32	32	32	27	27	26	26	24	24	21	21
30	32	32	30	30	28	28	25	25	23	23	22	22	20	20
40	30	30	27	27	25	25	23	23	21	21	19	19	18	18
50	28	20	26	20	24	20	22	20	20	20	19	19	16	16
60	26	18	23	18	22	18	19	18	19	18	17	17	16	16
70	24	15	22	15	20	15	18	15	17	15	16	15	14	14
80	22	13	20	13	18	13	17	13	15	13	14	13	13	13
90	20	13	18	13	16	13	16	13	15	13	14	13	11	11

TABLE 10
(Page 1 of 4)

BALANCED FISH RULE CURVES
FOR THE RED DEER RIVER

% exceedence	Apr. 2-8		Apr. 9-15		Apr. 16-22		Apr. 23-29		Apr. 30-May 6		May 7-13		May 14-20		May 21-27	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																
10	236	49	303	55	331	71	223	71	201	71	176	71	163	71	170	71
20	175	40	164	40	166	71	164	71	117	71	107	71	108	71	114	71
30	92	33	119	33	131	60	118	60	98	60	87	60	85	60	98	60
40	61	26	90	26	95	48	78	48	75	48	68	48	68	48	87	48
50	53	20	74	22	67	36	63	36	55	36	56	36	63	36	76	36
60	40	18	53	20	58	28	55	28	48	28	49	28	51	28	68	28
70	26	16	44	17	43	20	44	20	35	20	42	20	45	20	56	20
80	21	14	35	14	38	14	33	14	30	14	36	14	38	14	40	14
90	13	13	20	14	29	14	25	14	23	14	27	14	32	14	33	14
Reach 2																
10	163	49	246	55	231	59	197	59	140	59	140	70	149	70	177	70
20	98	40	108	40	138	59	119	59	96	59	116	59	102	61	122	70
30	66	33	73	33	102	49	96	49	78	49	94	49	84	53	100	56
40	41	26	68	26	61	40	62	40	66	40	67	40	75	43	86	43
50	32	20	45	22	50	30	52	30	58	30	51	30	63	30	77	30
60	24	18	38	20	42	25	42	25	47	25	48	25	57	25	67	25
70	21	16	30	17	38	19	32	19	37	19	40	19	48	19	52	19
80	17	14	26	14	32	14	27	14	28	14	34	14	37	14	44	14
90	9	9	18	14	20	14	21	14	22	14	26	14	30	14	37	14
Reach 3																
10	152	49	184	55	168	57	135	51	125	59	122	70	136	70	155	70
20	73	40	81	40	111	40	101	44	83	45	98	54	93	61	117	70
30	45	33	53	33	83	35	73	37	67	39	79	47	78	53	96	56
40	31	26	49	26	52	28	52	30	57	36	51	39	61	43	79	43
50	24	19	44	22	42	23	47	26	49	29	44	29	57	29	69	29
60	18	17	33	20	34	21	35	22	38	24	41	24	51	24	63	24
70	16	15	23	17	29	18	28	18	32	18	35	18	44	18	52	18
80	13	13	21	13	26	13	22	13	23	13	29	13	36	13	41	13
90	9	9	13	13	17	13	18	13	20	13	24	13	28	13	32	13
Reach 4																
10	49	49	55	55	57	57	51	51	59	59	71	70	84	70	91	70
20	30	30	34	34	38	38	44	44	45	45	54	54	61	61	84	70
30	23	23	27	27	35	35	37	37	39	39	47	47	53	53	72	56
40	19	19	24	24	28	28	30	30	36	36	39	39	45	43	62	43
50	16	16	22	22	23	23	26	26	31	29	34	29	42	29	57	29
60	15	15	20	20	21	21	22	22	28	24	30	24	39	24	50	24
70	14	14	17	17	19	18	19	18	22	18	28	18	37	18	45	18
80	11	11	15	13	17	13	17	13	19	13	22	13	32	13	41	13
90	9	9	13	13	14	13	14	13	17	13	19	13	23	13	29	13

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% exceed-ence	May 28-Jun. 3		Jun. 4-10		Jun. 11-17		Jun. 18-24		Jun. 25- Jul. 1		Jul. 2-8		Jul. 9-15		Jul. 16-22	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																
10	192	71	228	71	216	71	260	71	250	71	249	71	226	70	177	70
20	139	71	150	71	186	71	186	71	172	71	189	71	159	70	121	70
30	106	60	126	60	148	60	145	60	146	60	148	60	129	56	108	56
40	97	48	110	48	127	48	119	48	121	48	129	48	116	43	90	43
50	81	36	93	36	112	36	106	36	106	36	113	36	89	30	83	29
60	76	28	78	28	100	28	94	28	82	28	88	28	83	25	70	24
70	68	20	71	20	87	20	82	20	71	20	67	20	69	19	63	18
80	52	14	60	14	68	14	61	14	64	14	56	14	48	14	49	14
90	35	14	44	14	46	14	51	14	53	14	42	14	40	14	36	14
Reach 2																
10	203	70	210	70	203	70	273	70	256	70	216	70	176	70	152	70
20	139	70	150	70	168	70	179	70	163	70	166	70	134	70	99	70
30	114	56	125	56	146	56	129	56	130	56	143	56	113	56	92	56
40	96	43	107	43	119	43	106	43	109	43	122	43	94	43	80	43
50	87	30	99	30	107	30	98	30	96	30	110	30	85	30	72	29
60	75	25	80	25	97	25	84	25	80	25	86	25	77	25	64	24
70	64	19	68	19	85	19	73	19	66	19	61	19	64	19	57	18
80	52	14	62	14	65	14	62	14	57	14	51	14	45	14	49	14
90	40	14	43	14	44	14	52	14	43	14	42	14	37	14	37	14
Reach 3																
10	184	70	198	70	199	70	260	70	278	70	205	70	155	70	142	70
20	125	70	146	70	162	70	160	70	149	70	157	70	122	70	94	70
30	107	56	116	56	142	56	121	56	128	56	133	56	105	56	85	56
40	91	43	102	43	113	43	103	43	106	43	115	43	88	43	74	43
50	86	29	97	29	99	29	98	29	92	29	95	29	78	29	67	29
60	71	24	75	24	94	24	75	24	79	24	81	24	72	24	61	24
70	57	18	68	18	82	18	70	18	62	18	60	18	60	18	54	18
80	48	13	55	13	63	13	60	13	52	13	50	13	43	13	44	13
90	37	13	43	13	43	13	51	13	41	13	39	13	34	13	35	13
Reach 4																
10	134	70	155	70	139	70	158	70	161	70	153	70	127	70	104	70
20	98	70	112	70	127	70	113	70	111	70	121	70	102	70	87	70
30	83	56	96	56	107	56	94	56	98	56	103	56	80	56	72	56
40	77	43	87	43	92	43	87	43	85	43	90	43	74	43	66	43
50	68	29	71	29	83	29	83	29	78	29	85	29	69	29	59	29
60	59	24	68	24	75	24	69	24	67	24	76	24	65	24	54	24
70	51	18	59	18	66	18	58	18	56	18	60	18	58	18	49	18
80	45	13	47	13	61	13	54	13	48	13	46	13	43	13	43	13
90	33	13	40	13	42	13	46	13	39	13	37	13	34	13	33	13

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(Page 3 of 4)

% exceed-ence	Jul. 23-29		Jul. 30- Aug. 5		Aug. 6-12		Aug. 13-19		Aug. 20-26		Aug. 27- Sep. 2		Sep. 3-9		Sep. 10-16	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1																
10	136	70	136	70	110	70	96	70	87	60	84	57	80	48	69	52
20	101	70	107	69	88	69	80	57	77	51	61	50	58	42	52	40
30	86	56	89	56	78	56	70	52	64	46	56	43	51	36	45	36
40	75	43	70	43	67	43	57	43	55	43	51	39	47	34	43	33
50	64	29	57	29	59	29	52	29	52	29	47	29	43	29	40	29
60	60	24	53	24	51	24	48	24	45	24	44	24	40	24	37	24
70	53	18	51	18	46	18	44	18	41	18	39	18	36	18	33	18
80	44	14	40	14	41	14	38	14	37	14	33	14	31	14	28	14
90	35	14	34	14	35	14	33	14	32	14	30	14	28	14	25	14
Reach 2																
10	122	70	123	70	99	70	86	70	72	60	79	57	70	48	70	52
20	96	70	92	69	80	69	71	57	62	51	62	50	53	42	47	40
30	80	56	70	56	73	56	58	52	54	46	52	43	43	36	42	36
40	67	43	64	43	60	43	51	43	50	43	45	39	41	34	38	33
50	61	29	55	29	50	29	46	29	43	29	43	29	38	29	36	29
60	57	24	50	24	46	24	43	24	39	24	37	24	35	24	33	24
70	52	18	47	18	43	18	41	18	36	18	34	18	30	18	30	18
80	42	14	44	14	38	14	36	14	33	14	30	14	27	14	25	14
90	32	14	36	14	36	14	30	14	29	14	27	14	26	14	24	14
Reach 3																
10	120	70	107	70	95	70	82	70	66	60	75	57	65	48	66	52
20	88	70	81	69	76	69	64	57	59	51	59	50	47	42	43	40
30	72	56	67	56	69	56	58	52	51	46	48	43	40	36	39	36
40	61	43	60	43	51	43	48	43	47	43	42	39	39	34	36	33
50	59	29	52	29	46	29	44	29	41	29	38	29	34	29	34	29
60	52	24	48	24	43	24	41	24	36	24	34	24	32	24	31	24
70	49	18	45	18	41	18	38	18	34	18	32	18	29	18	28	18
80	41	13	41	13	36	13	35	13	31	13	28	13	27	13	23	13
90	32	13	35	13	34	13	30	13	28	13	26	13	25	13	22	13
Reach 4																
10	98	70	88	70	78	70	73	70	60	60	57	57	48	48	52	52
20	76	70	69	69	69	69	57	57	51	51	50	50	42	42	38	38
30	70	56	59	56	56	56	52	52	46	46	43	43	36	36	36	36
40	59	43	54	43	50	43	44	43	43	43	39	39	34	34	33	33
50	53	29	50	29	43	29	41	29	39	29	36	29	33	29	30	29
60	50	24	46	24	41	24	39	24	36	24	34	24	31	24	28	24
70	47	18	43	18	39	18	37	18	35	18	31	18	28	18	26	18
80	39	13	40	13	36	13	33	13	30	13	28	13	26	13	23	13
90	30	13	34	13	30	13	28	13	28	13	26	13	24	13	21	13

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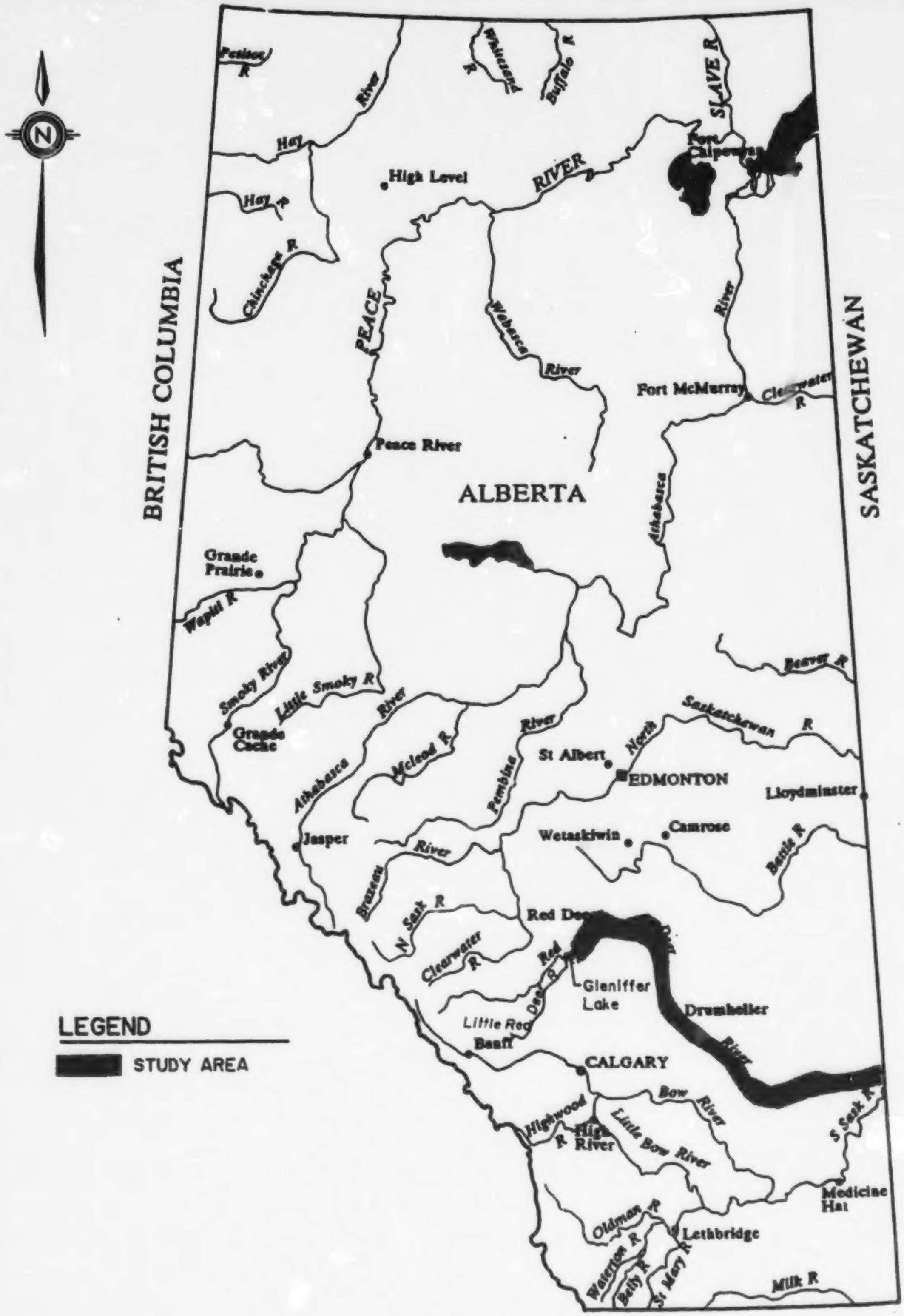
% exceedence	Sep. 17-23		Sep. 24-30		Oct. 1-7		Oct. 8-14		Oct. 15-21		Oct. 22-28		Oct. 29- Nov. 4	
	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC	NAT	FRC
Reach 1														
10	85	54	77	54	67	54	61	50	51	43	47	34	39	34
20	50	43	50	40	45	38	42	34	37	34	34	34	32	32
30	46	36	42	34	40	35	37	30	34	27	32	27	31	27
40	41	34	40	31	38	29	33	28	31	26	29	23	26	23
50	38	25	36	25	31	25	32	23	29	24	27	20	25	20
60	36	21	34	21	30	21	28	21	26	20	24	19	21	17
70	34	17	30	17	28	17	26	17	24	17	22	17	20	16
80	27	14	26	14	25	14	24	14	21	14	20	14	16	14
90	21	14	21	14	19	14	17	14	17	14	17	14	14	13
Reach 2														
10	68	54	69	54	54	54	54	50	46	43	37	34	31	30
20	44	43	43	40	42	38	36	33	32	30	30	30	27	27
30	38	36	36	34	37	35	32	30	29	27	27	27	25	25
40	36	34	32	31	32	29	29	28	28	26	24	23	23	23
50	33	25	31	25	27	25	25	23	24	24	22	20	20	20
60	31	21	26	21	25	21	22	21	22	20	20	19	17	17
70	27	17	25	17	23	17	21	17	20	17	18	17	16	16
80	23	14	21	14	21	14	19	14	18	14	17	14	14	14
90	20	14	20	14	18	14	17	14	16	14	15	14	12	12
Reach 3														
10	64	54	64	54	57	54	50	50	43	43	34	34	30	30
20	43	43	40	40	38	38	33	33	30	30	29	29	26	26
30	36	36	34	34	35	35	30	30	27	27	25	25	23	23
40	34	34	31	31	29	29	28	28	26	26	23	23	21	21
50	30	25	29	25	26	25	23	23	24	24	20	20	18	18
60	29	21	25	21	24	21	22	21	20	20	19	19	16	16
70	25	17	24	17	21	17	20	17	18	17	17	17	16	16
80	22	13	21	13	20	13	19	13	17	13	16	13	13	13
90	19	13	18	13	17	13	16	13	15	13	14	13	11	11
Reach 4														
10	47	47	44	44	40	40	36	36	31	31	26	26	23	23
20	38	38	32	32	32	32	27	27	26	26	24	24	21	21
30	32	32	30	30	28	28	25	25	23	23	22	22	20	20
40	30	30	27	27	25	25	23	23	21	21	19	19	18	18
50	28	20	26	20	24	20	22	20	20	20	19	19	16	16
60	26	18	23	18	22	18	19	18	19	18	17	17	16	16
70	24	15	22	15	20	15	18	15	17	15	16	15	14	14
80	22	13	20	13	18	13	17	13	15	13	14	13	13	13
90	20	13	18	13	16	13	16	13	15	13	14	13	11	11

LOCATION OF STUDY AREA

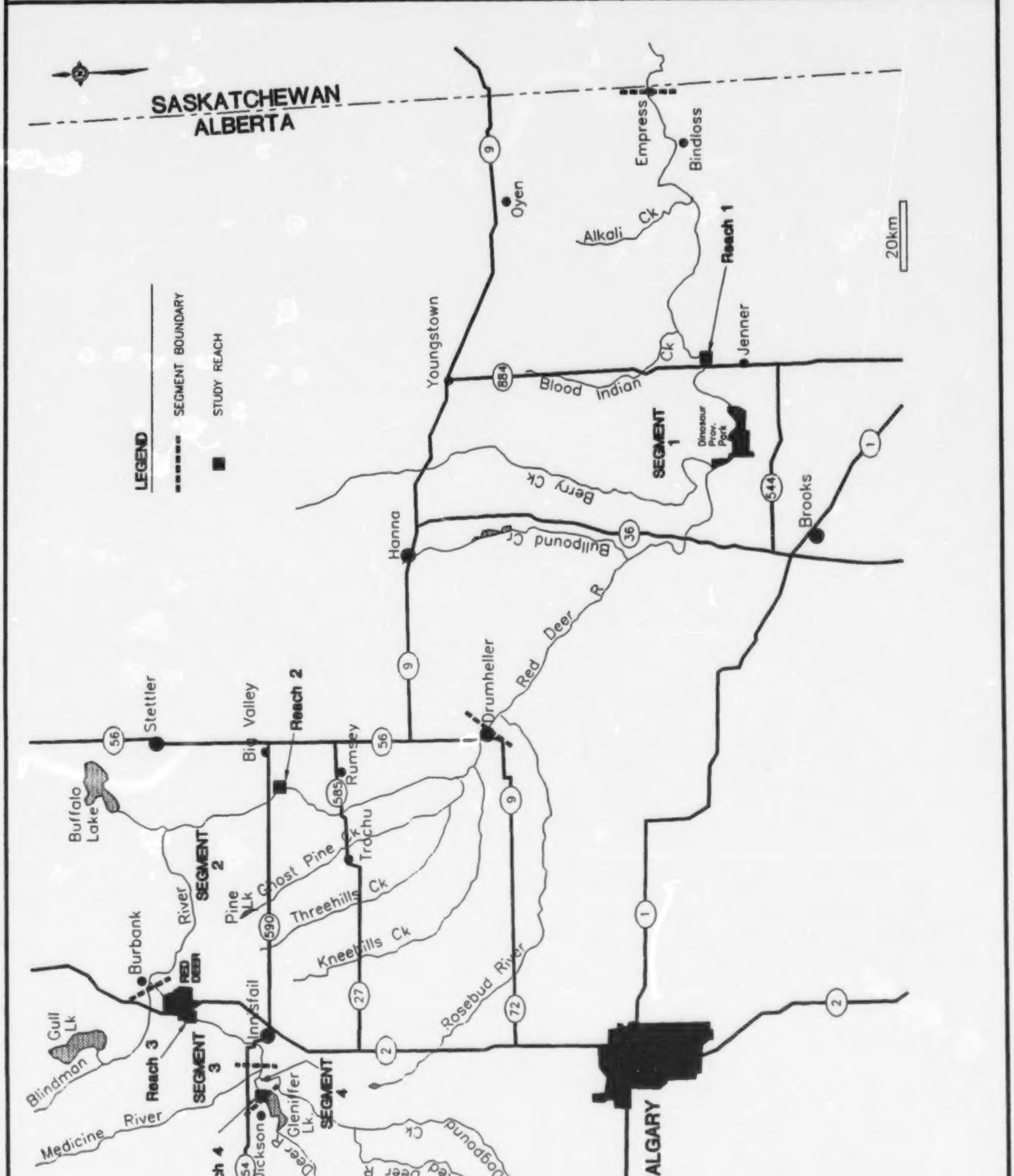
Figure 1



PROJECT No. 942-2299 DRAWN CG REVIEWED DATE 29 DEC 93

LOCATIONS OF SEGMENT BOUNDARIES AND REPRESENTATIVE STUDY REACHES, RED DEER RIVER STUDY AREA

Figure 2



PROJECT 962-2306 DRAWN RK REVIEWED ______ DATE 21 MAY 96 2299RED.dwg

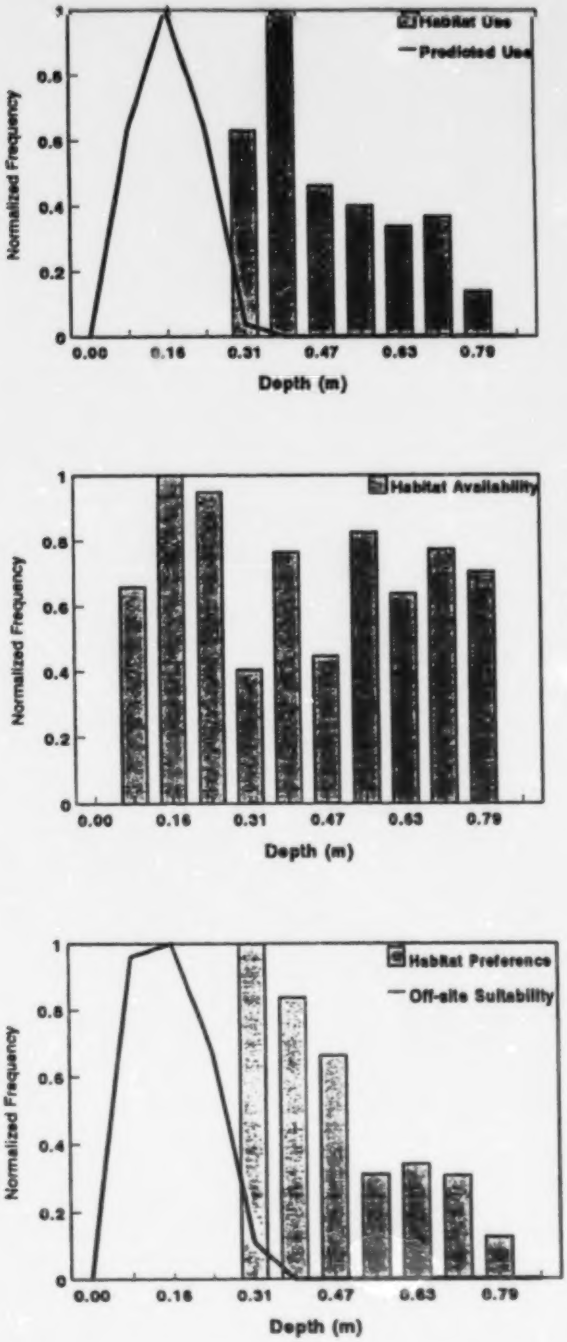


Figure 3 Transferability analysis for brown trout fry depth preference, Red Deer River.

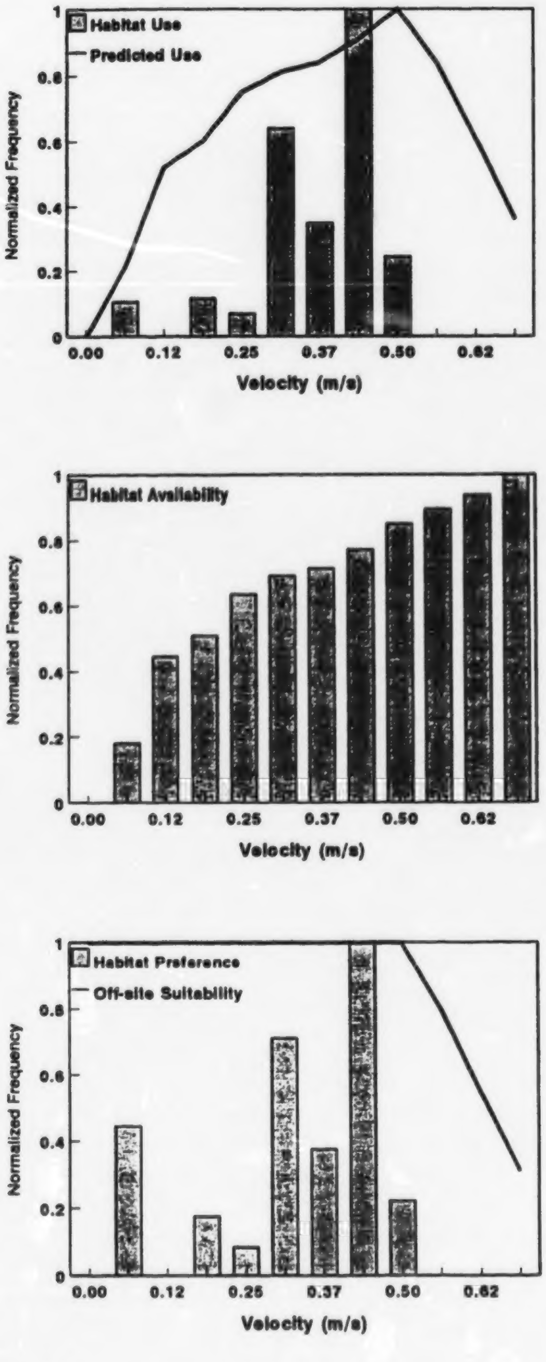


Figure 4 Transferability analysis for brown trout fry velocity preference, Red Deer River.

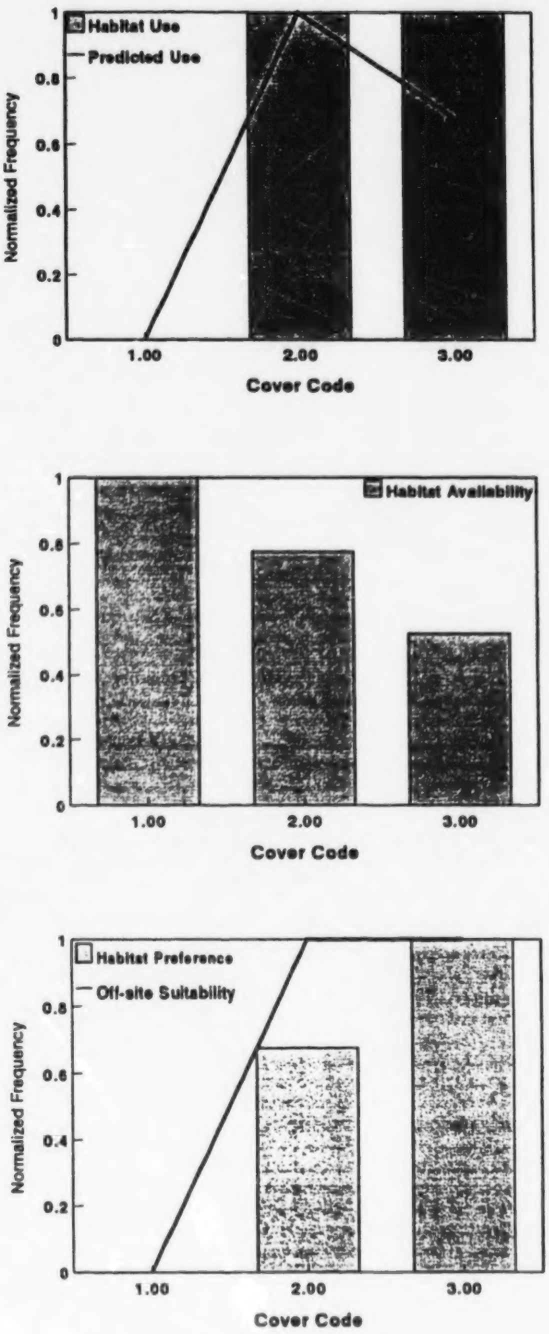


Figure 5 Transferability analysis for brown trout fry cover preference, Red Deer River.

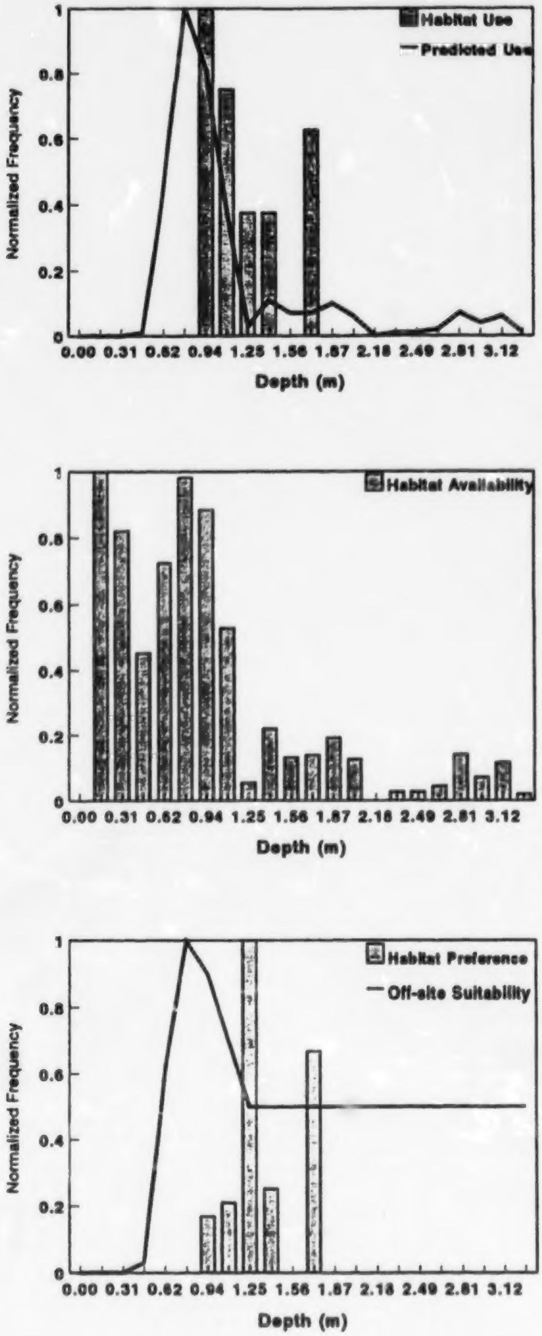


Figure 6 Transferability analysis for brown trout juvenile depth preference, Red Deer River.

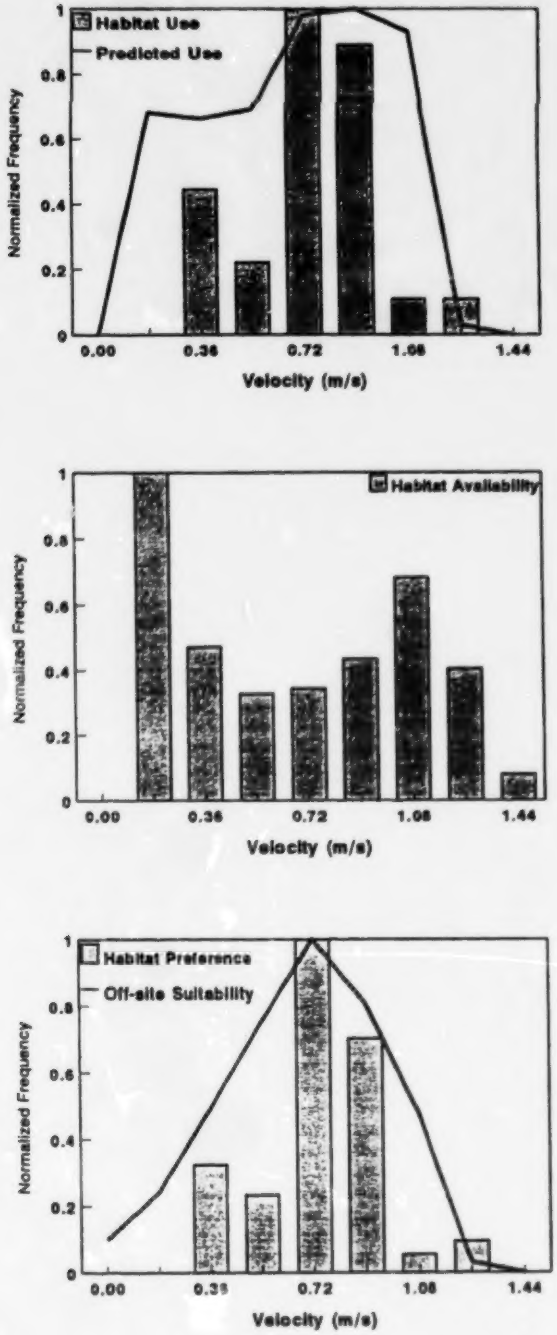


Figure 7

Transferability analysis for brown trout juvenile velocity preference, Red Deer River.

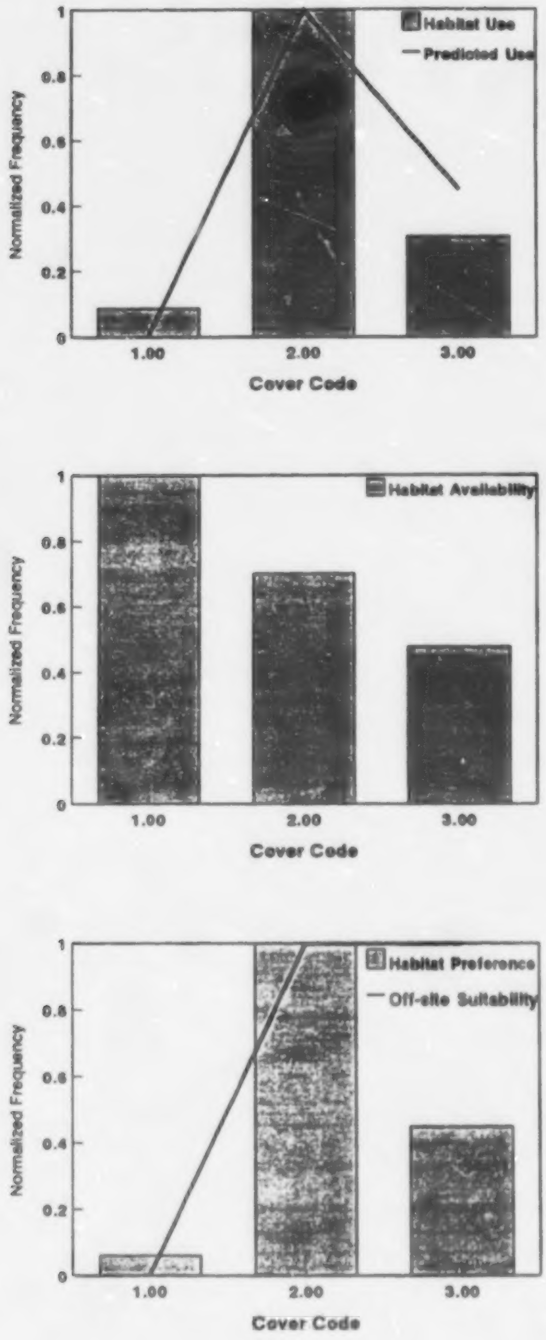


Figure 8 Transferability analysis for brown trout juvenile cover preference,Red Deer River.

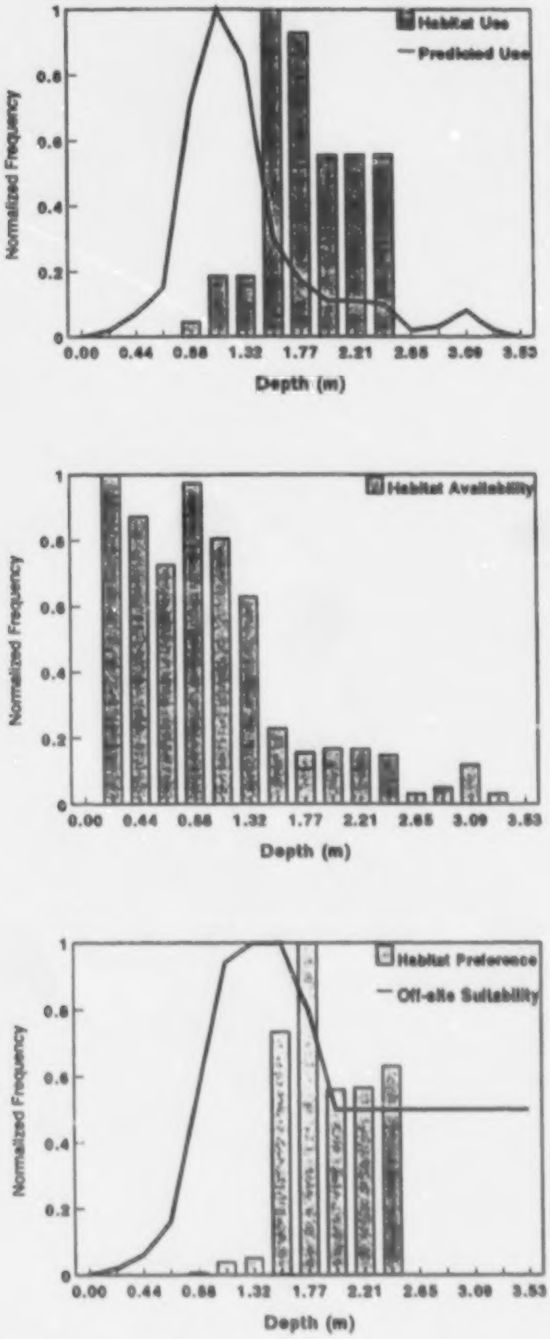


Figure 9 Transferability analysis for brown trout adult depth preference, Red Deer River.

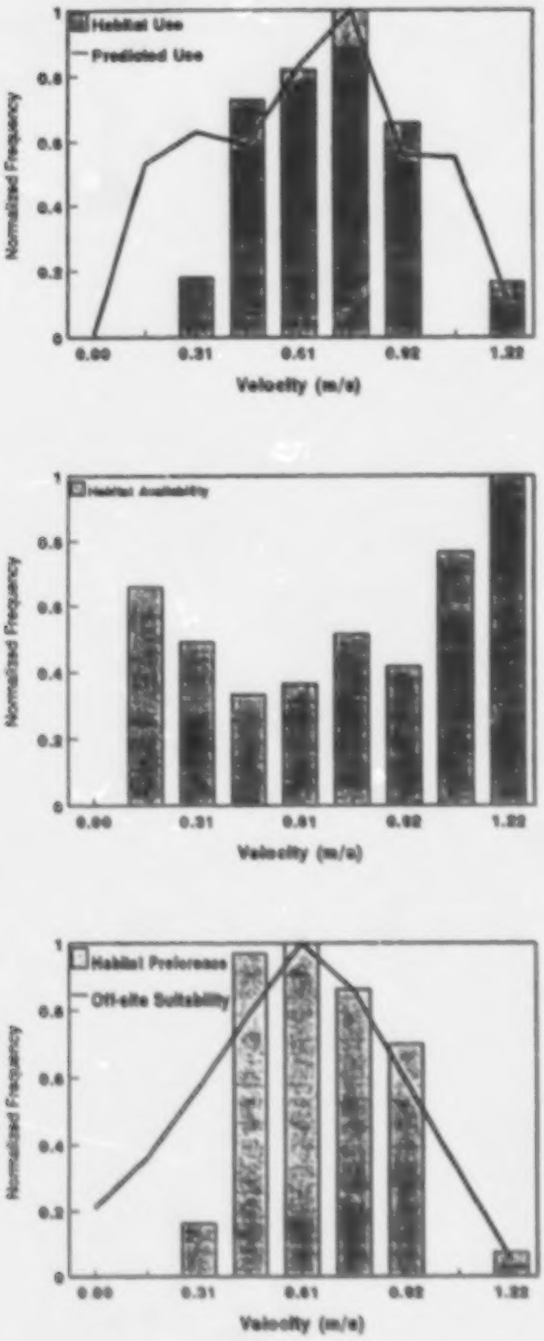


Figure 10 Transferability analysis for brown trout adult velocity preference, Red Deer River.

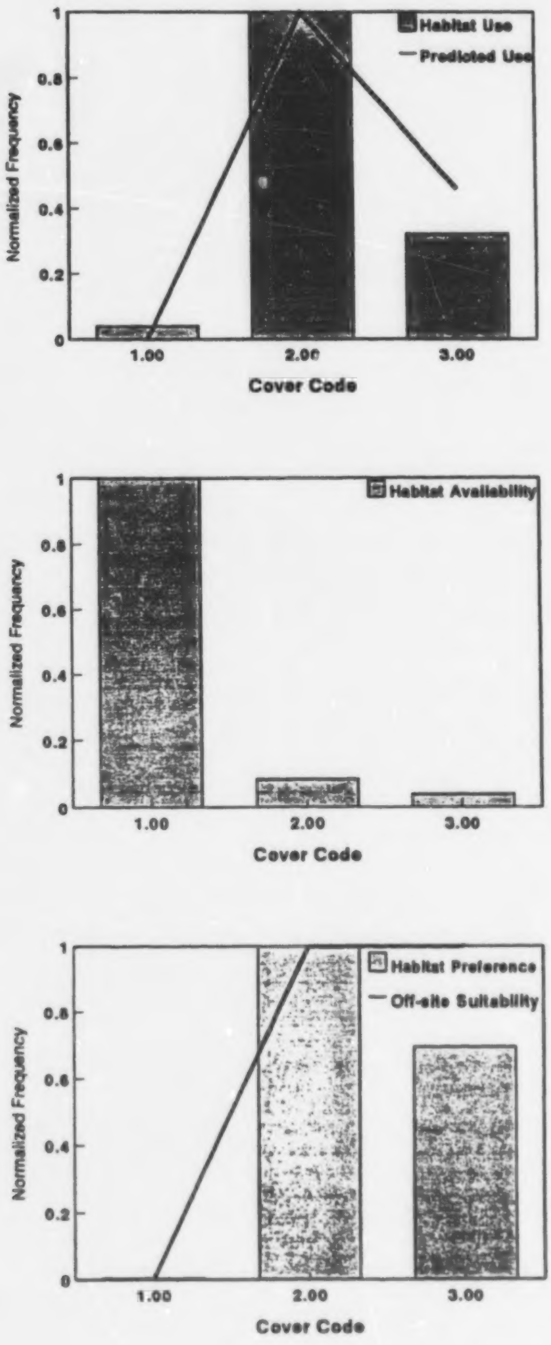


Figure 11 Transferability analysis for brown trout adult cover preference, Red Deer River.

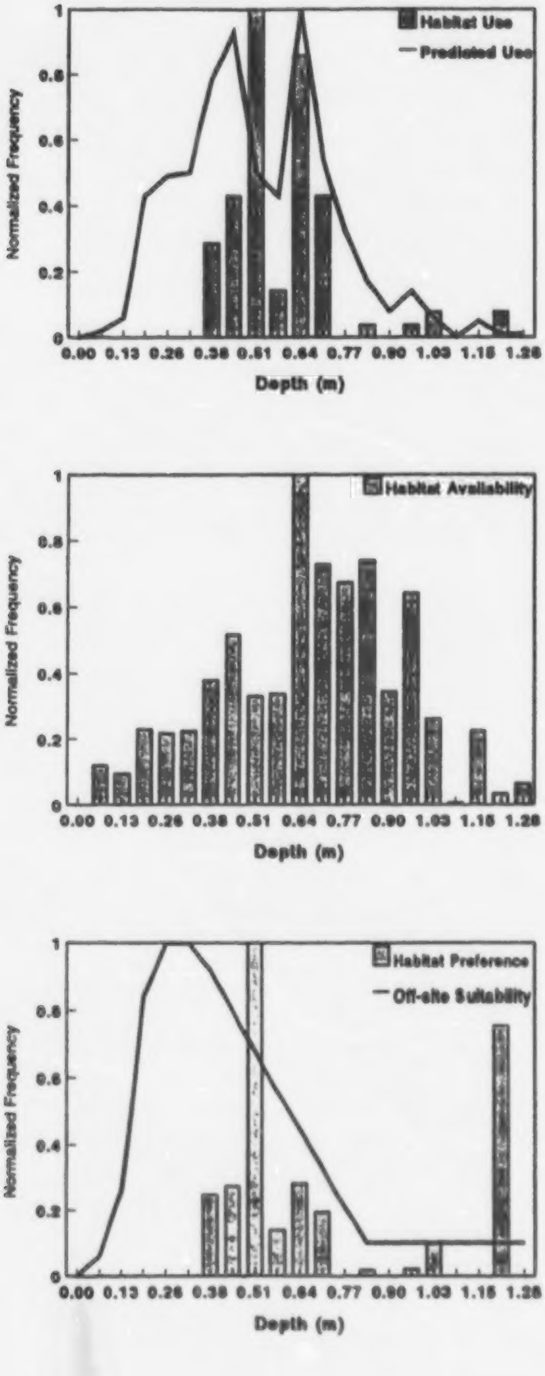


Figure 12 Transferability analysis for brown trout spawning depth preference, Red Deer River.

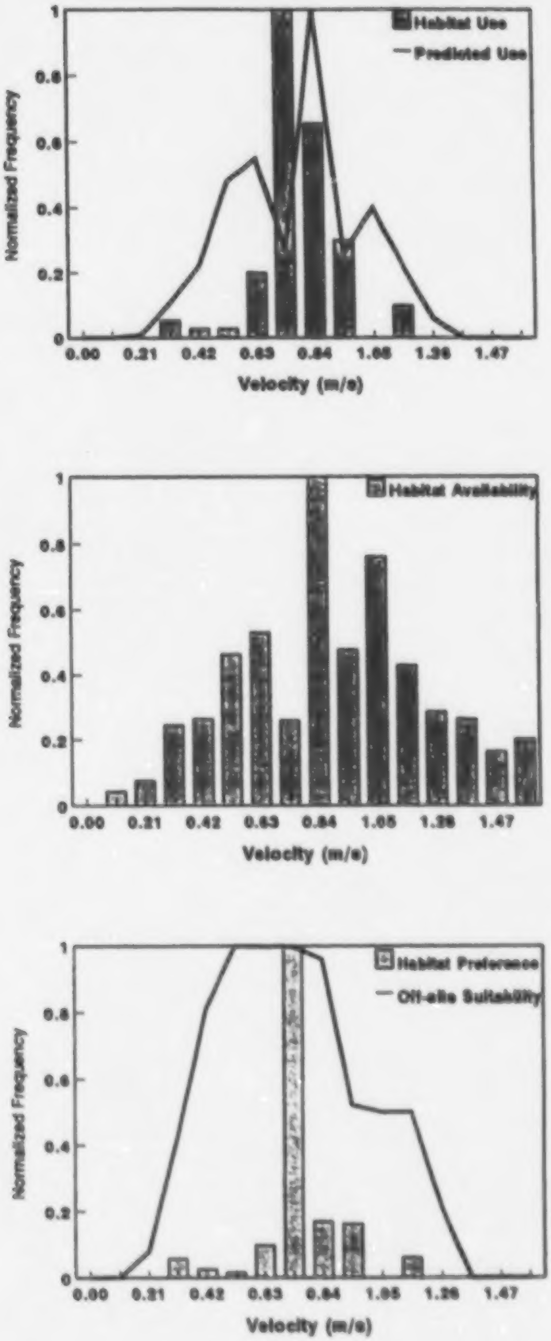


Figure 13 Transferability analysis for brown trout spawning velocity preference, Red Deer River.

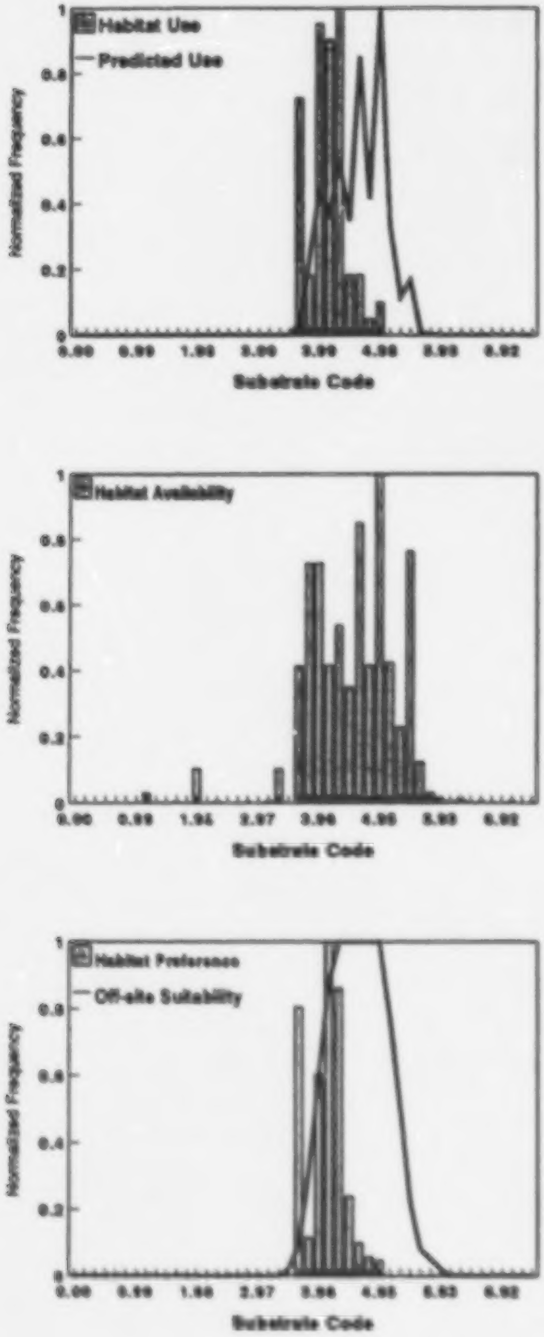


Figure 14 Transferability analysis for brown trout spawning substrate preference, Red Deer River.

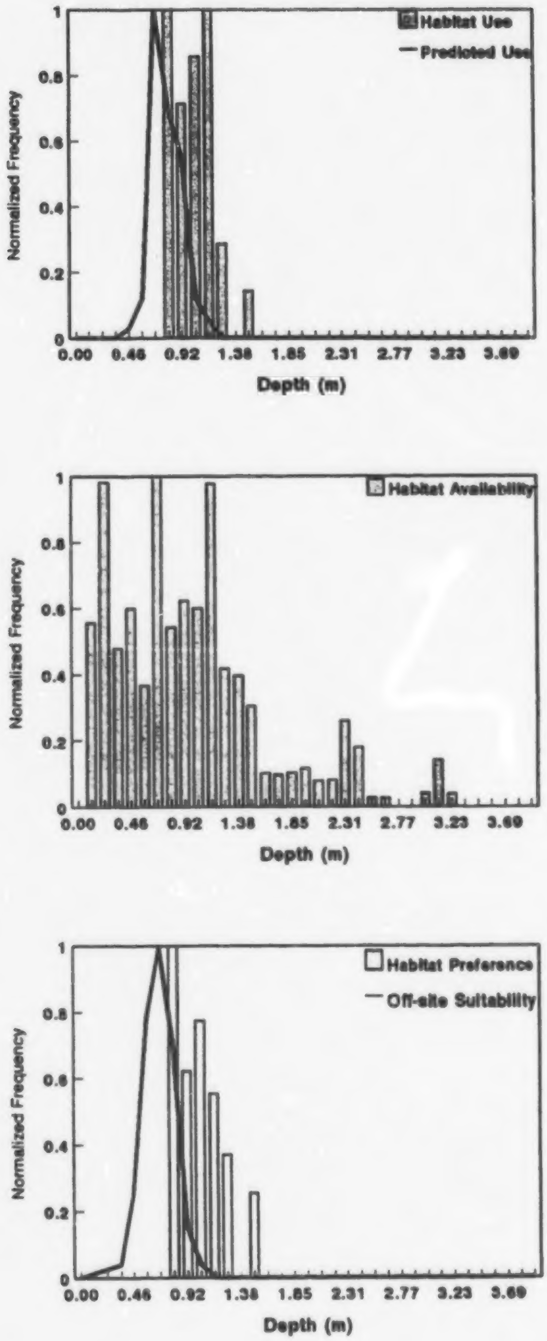


Figure 15 Transferability analysis for mountain whitefish fry depth preference, Red Deer River.

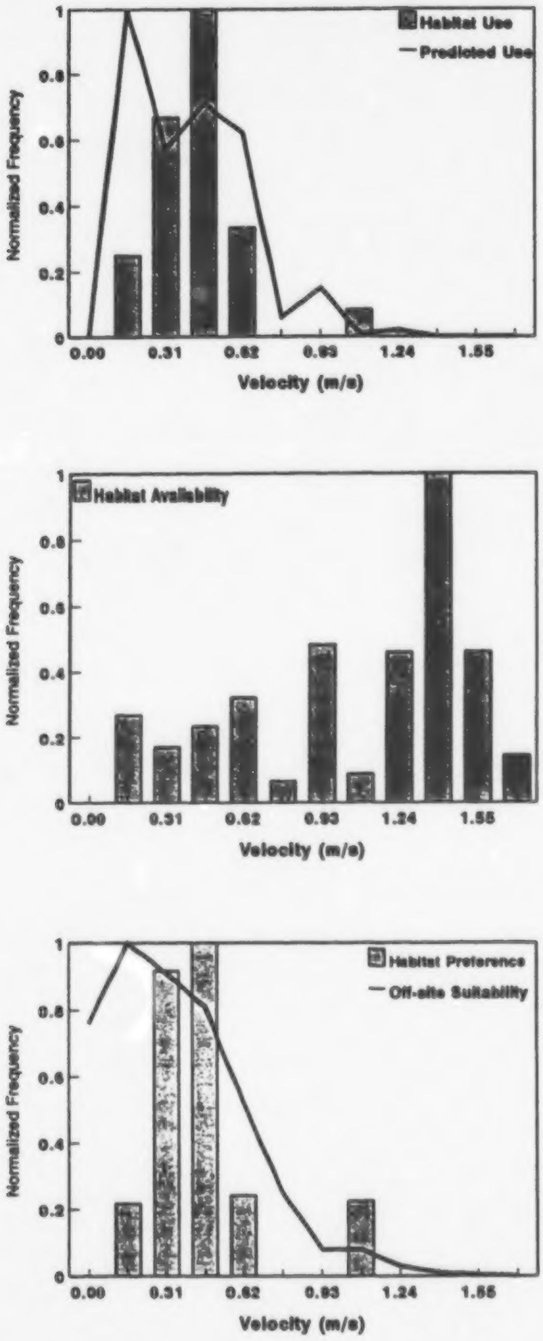


Figure 16 Transferability analysis for mountain whitefish fry velocity preference, Red Deer River.

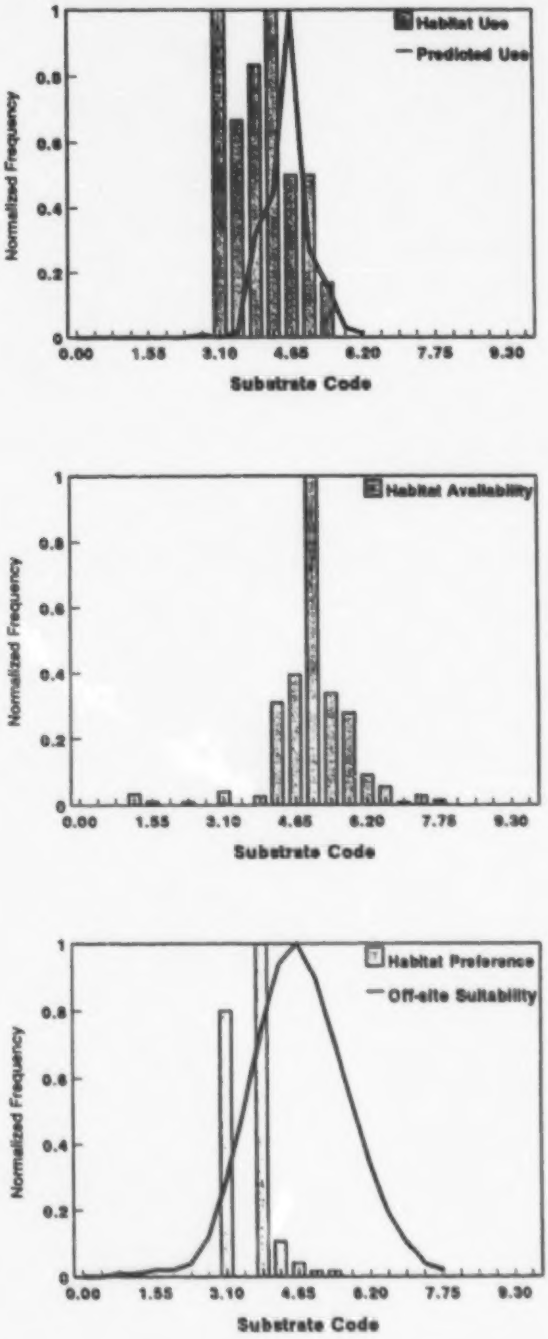


Figure 17 Transferability analysis for mountain whitefish fry substrate preference, Red Deer River.

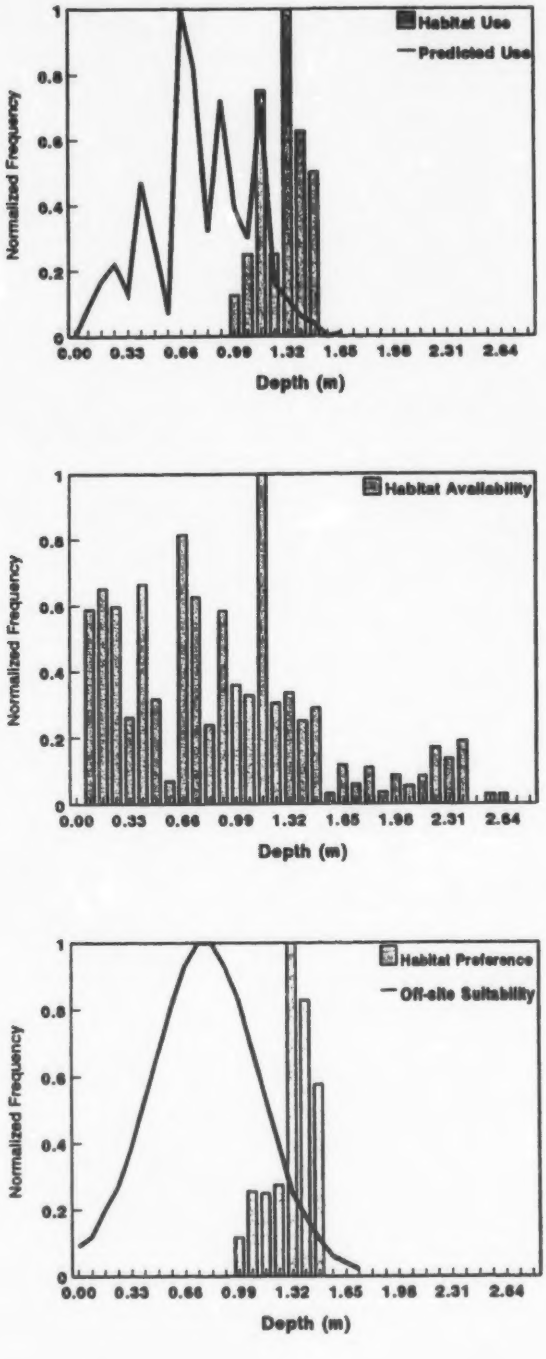


Figure 18 Transferability analysis for mountain whitefish juvenile depth preference, Red Deer River.

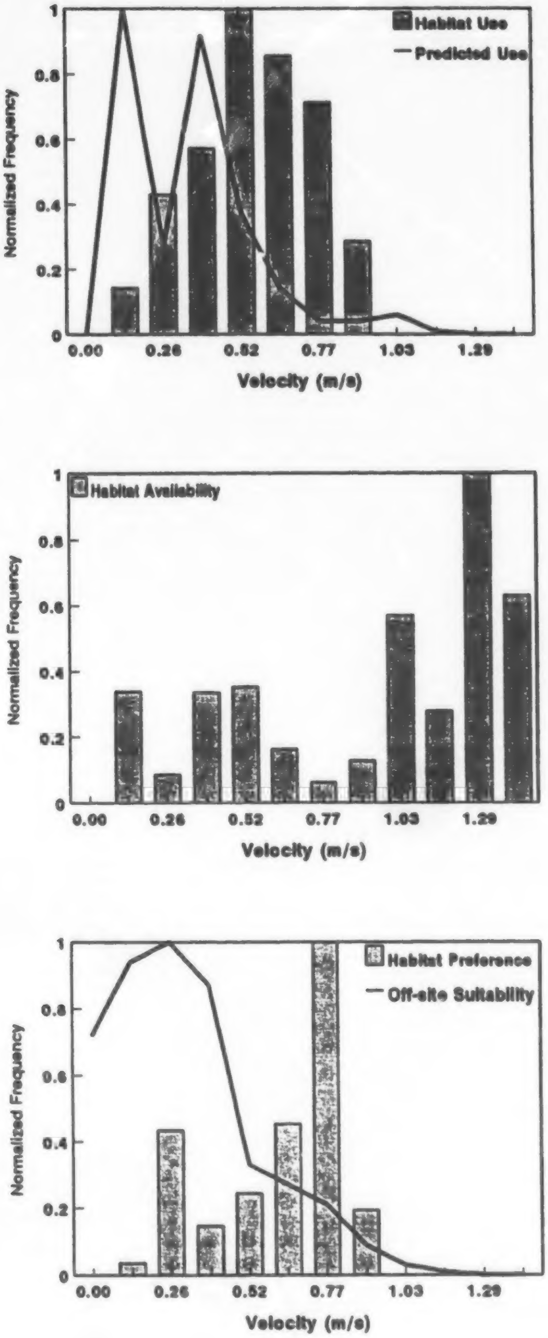


Figure 19 Transferability analysis for mountain whitefish juvenile velocity preference, Red Deer River.

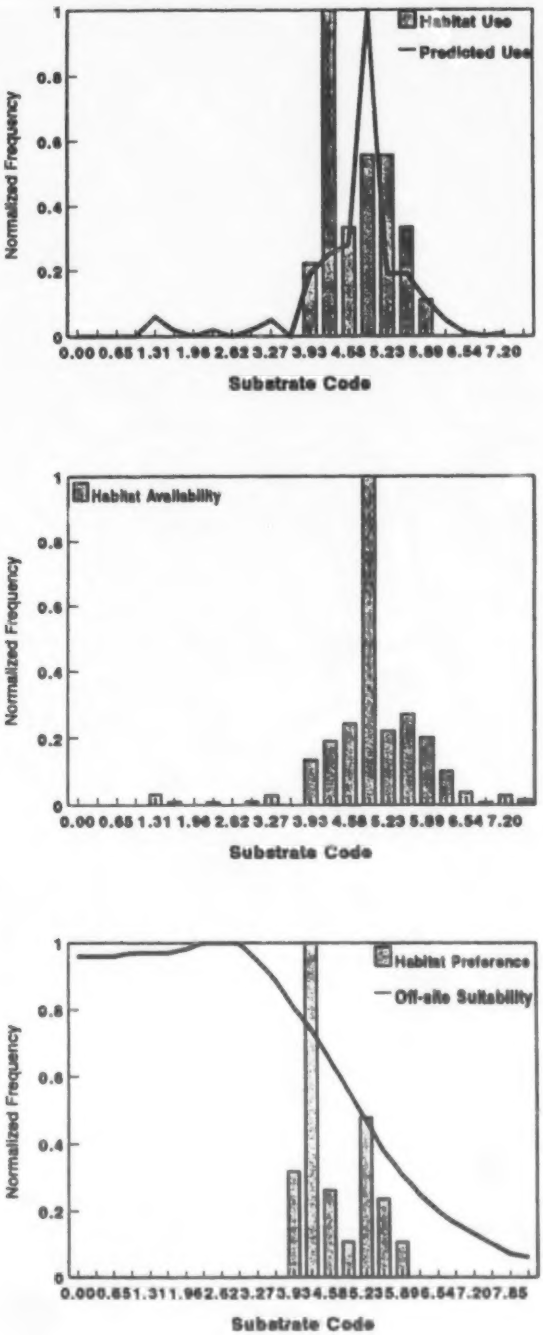


Figure 20 Transferability analysis for mountain whitefish juvenile substrate preference, Red Deer River.

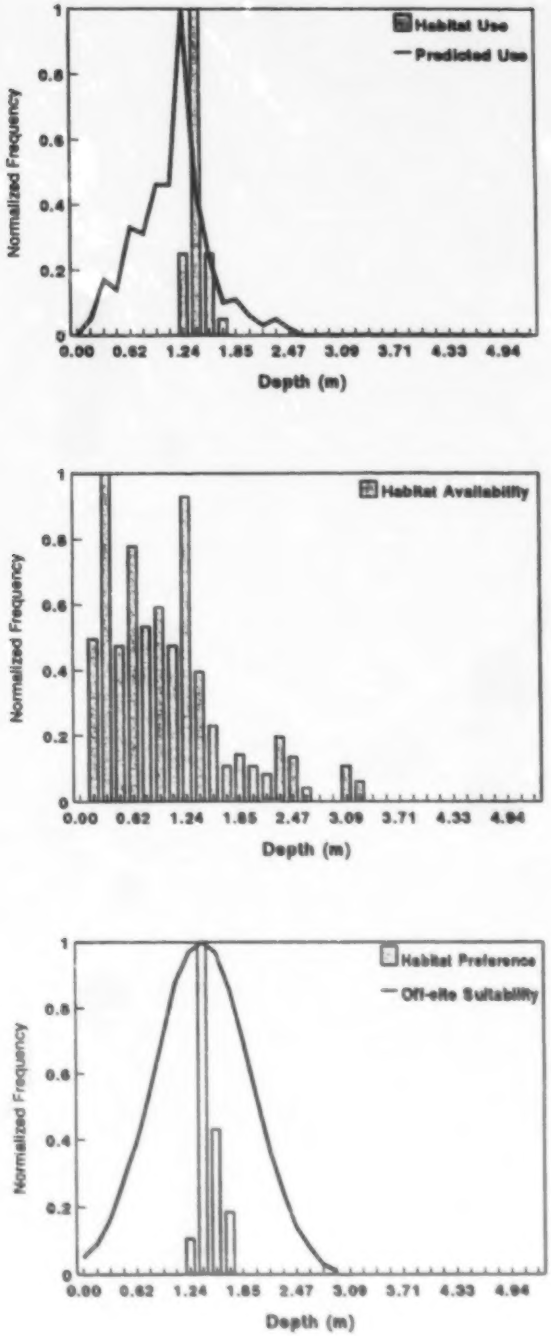


Figure 21 Transferability analysis for mountain whitefish adult depth preference, Red Deer River.

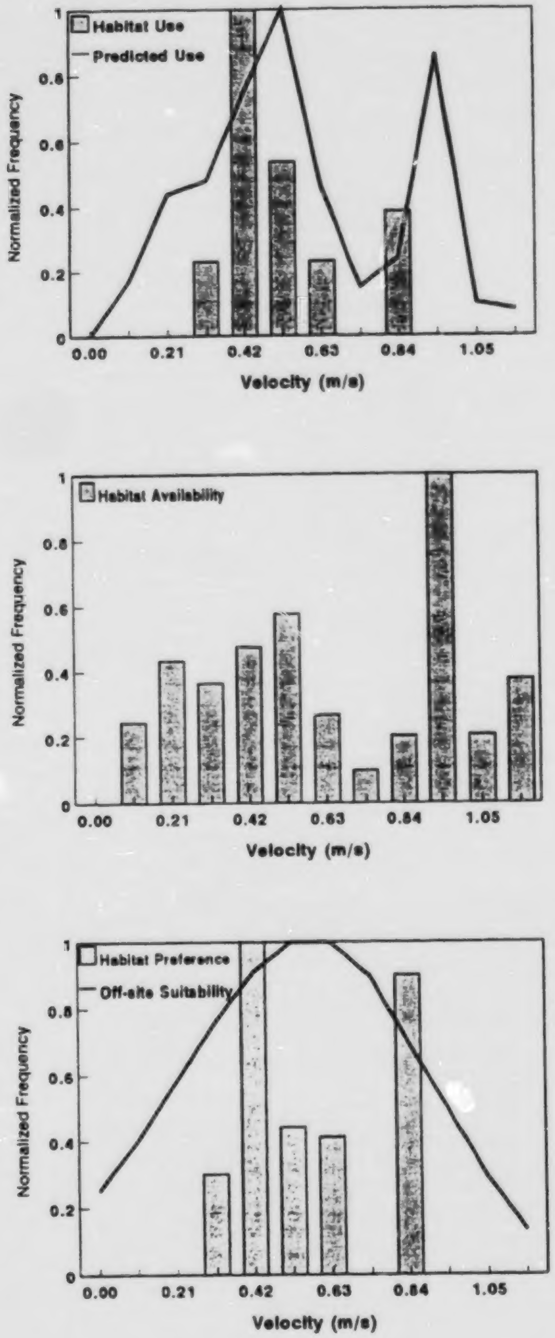


Figure 22 Transferability analysis for mountain whitefish adult velocity preference criteria, Red Deer River.

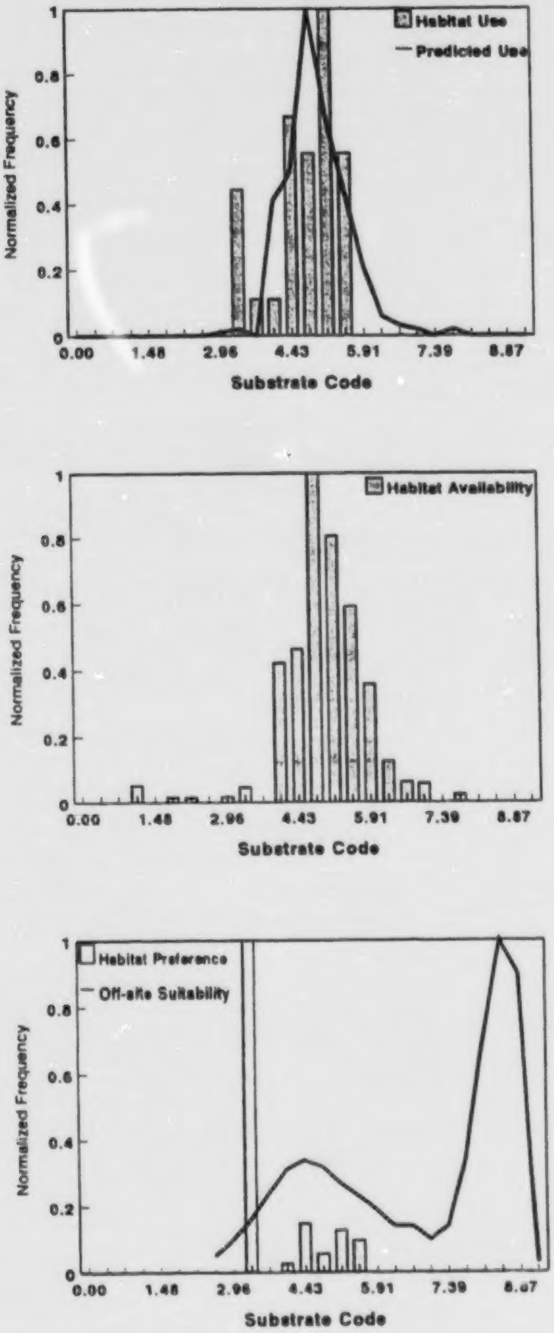


Figure 23 Transferability analysis for mountain whitefish adult substrate preference criteria, Red Deer River.

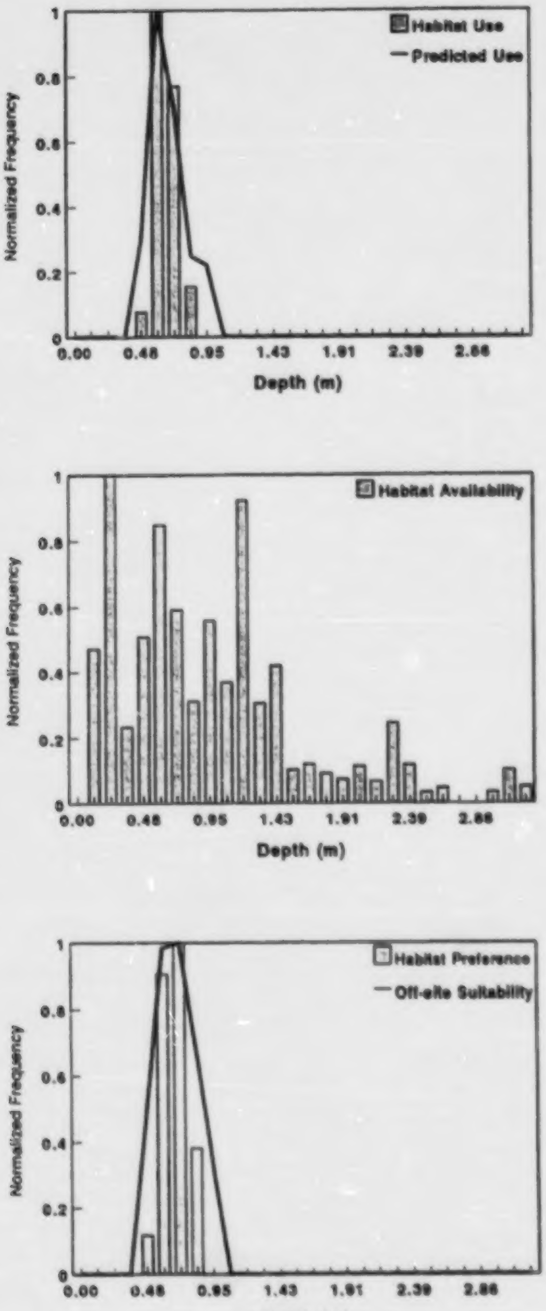


Figure 24 Transferability analysis for mountain whitefish spawning depth preference, Red Deer River.

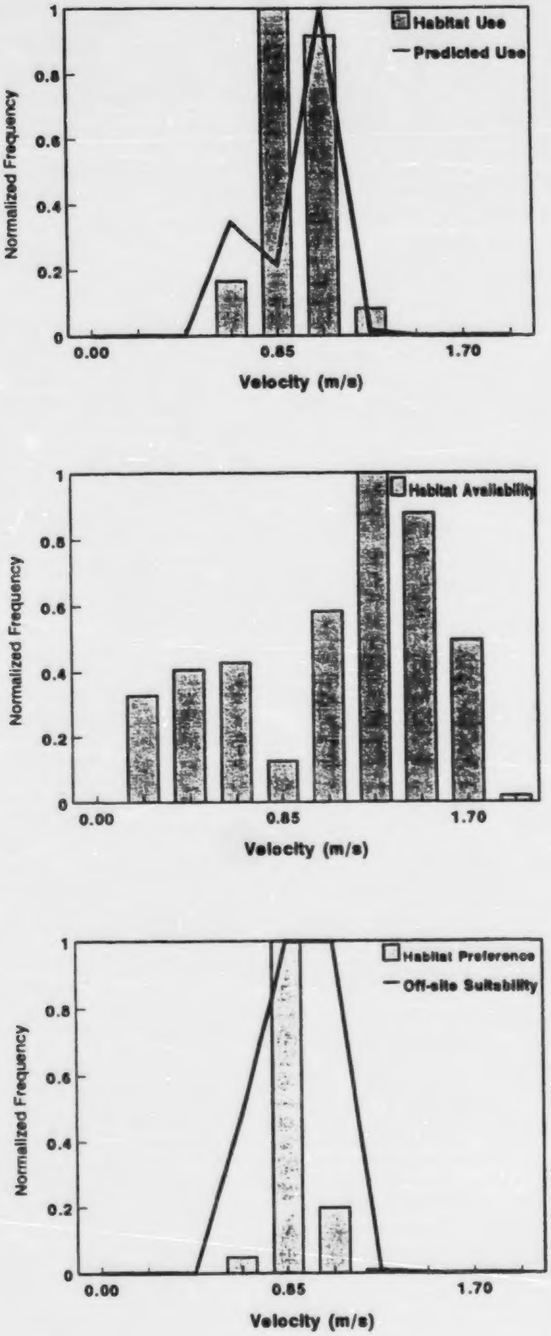


Figure 25 Transferability analysis for mountain whitefish spawning velocity preference, Red Deer River.

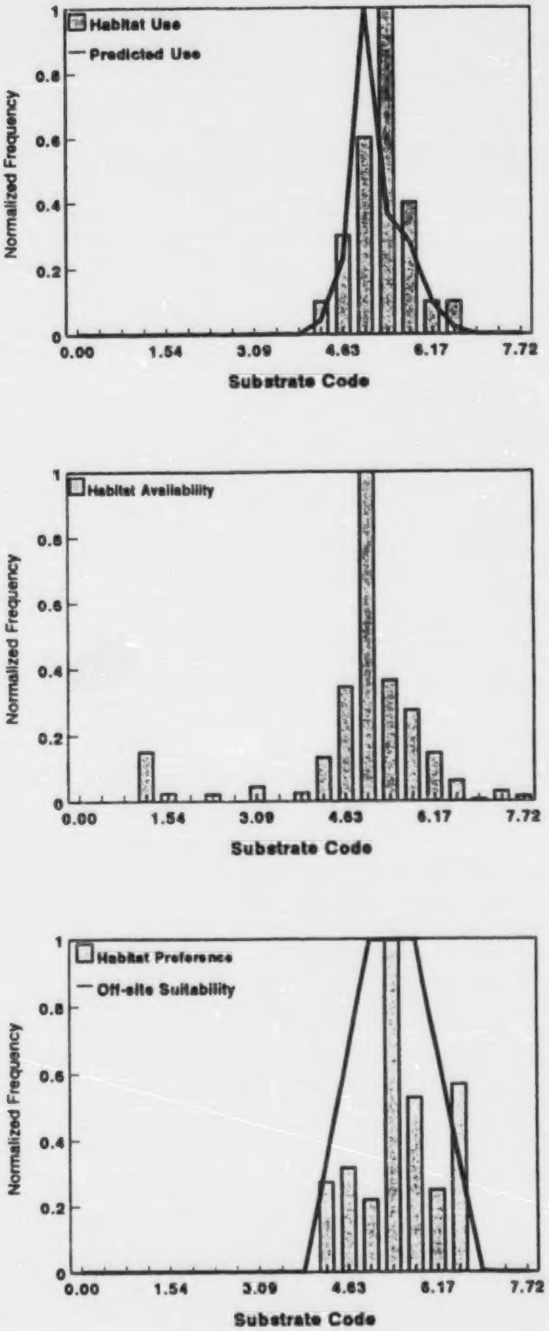


Figure 26 Transferability analysis for mountain whitefish spawning substrate preference, Red Deer River.

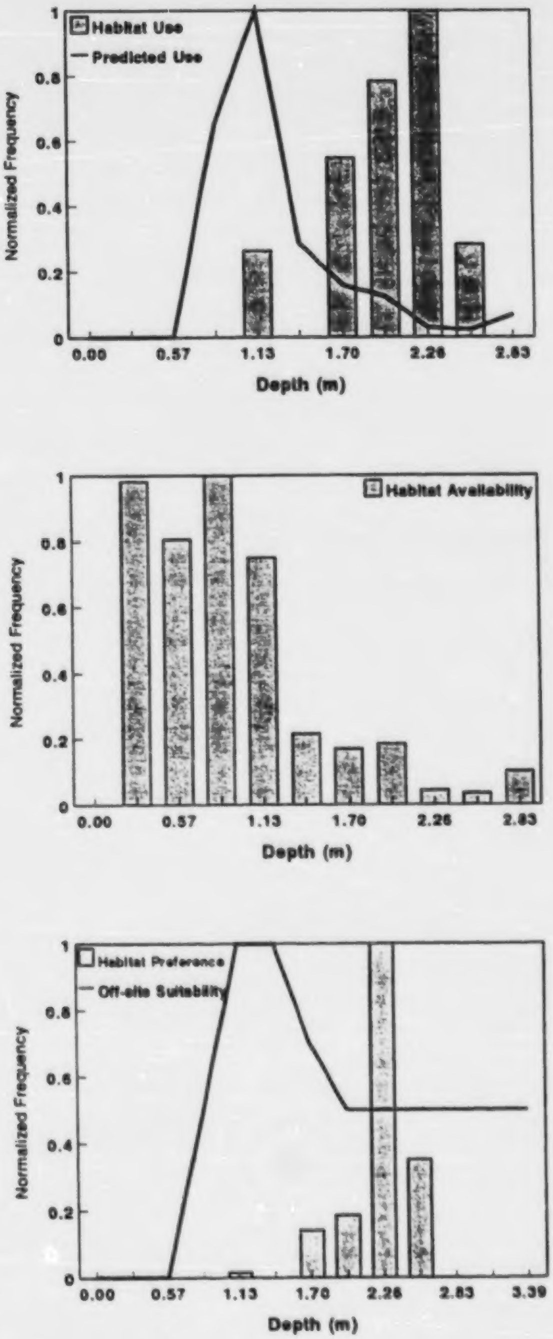


Figure 27 Transferability analysis for walleye juvenile habitat preference criteria for depth, Red Deer River.

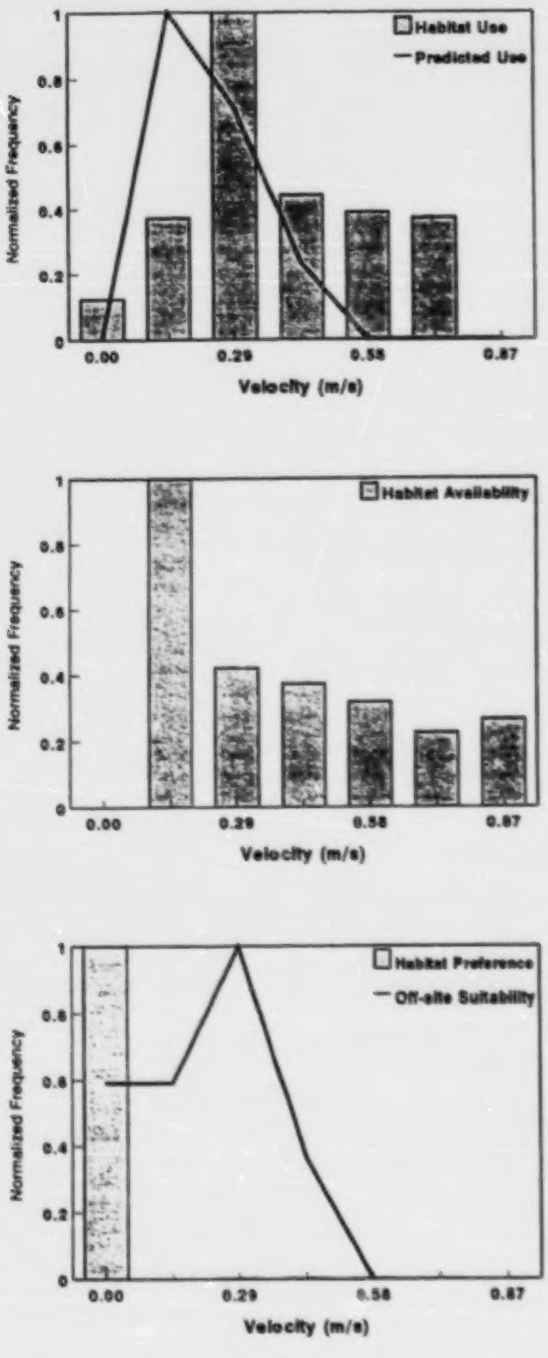


Figure 28 Transferability analysis for walleye juvenile velocity preference, Red Deer River.

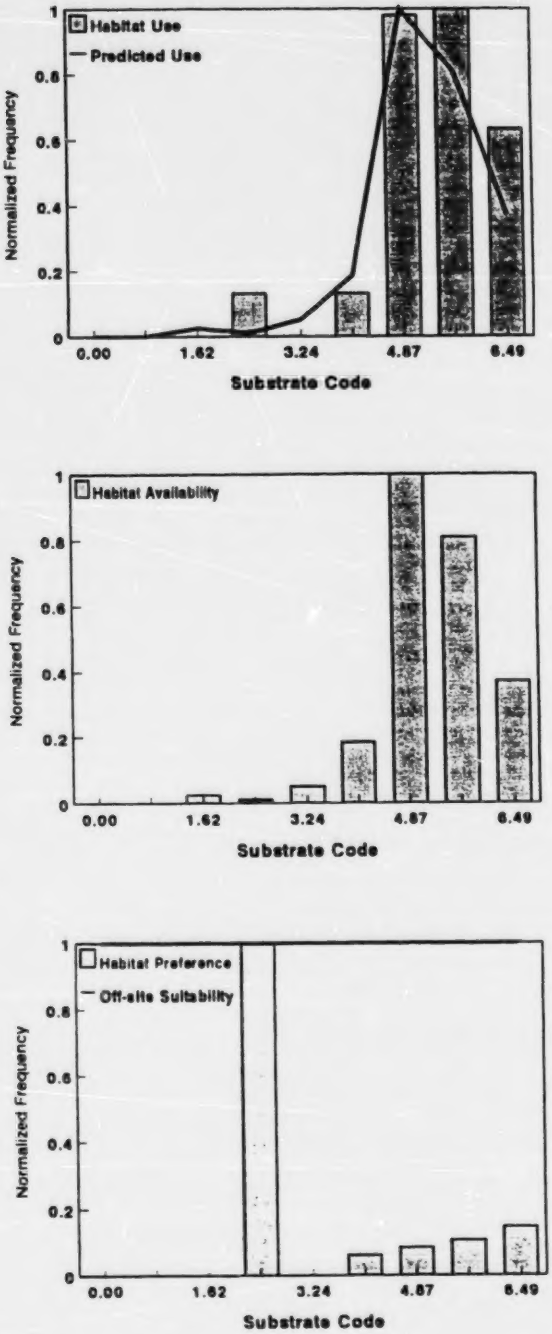


Figure 29 Transferability analysis for walleye juvenile substrate preference, Red Deer River.

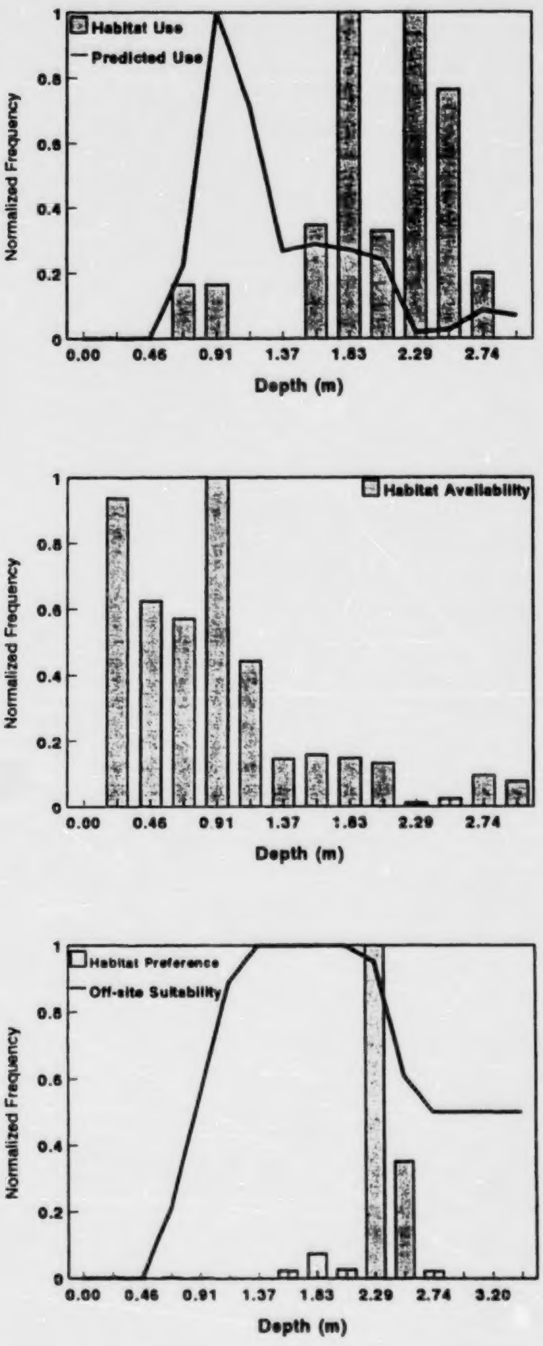


Figure 30 Transferability analysis for walleye adult depth preference, Red Deer River.

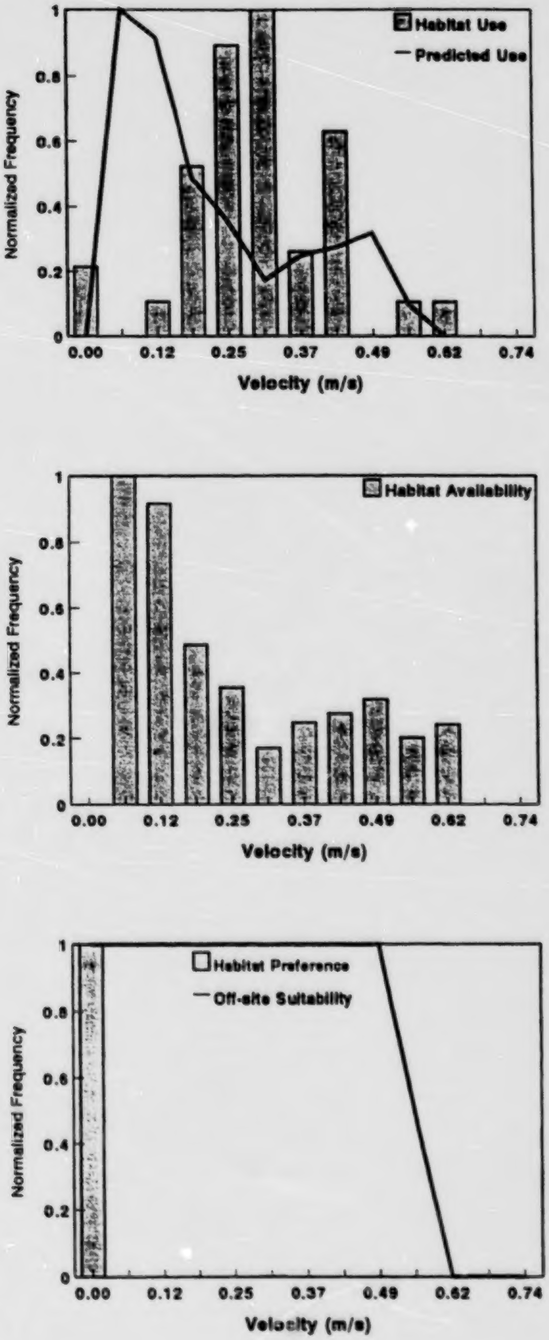


Figure 31 Transferability analysis for walleye adult velocity preference, Red Deer River.

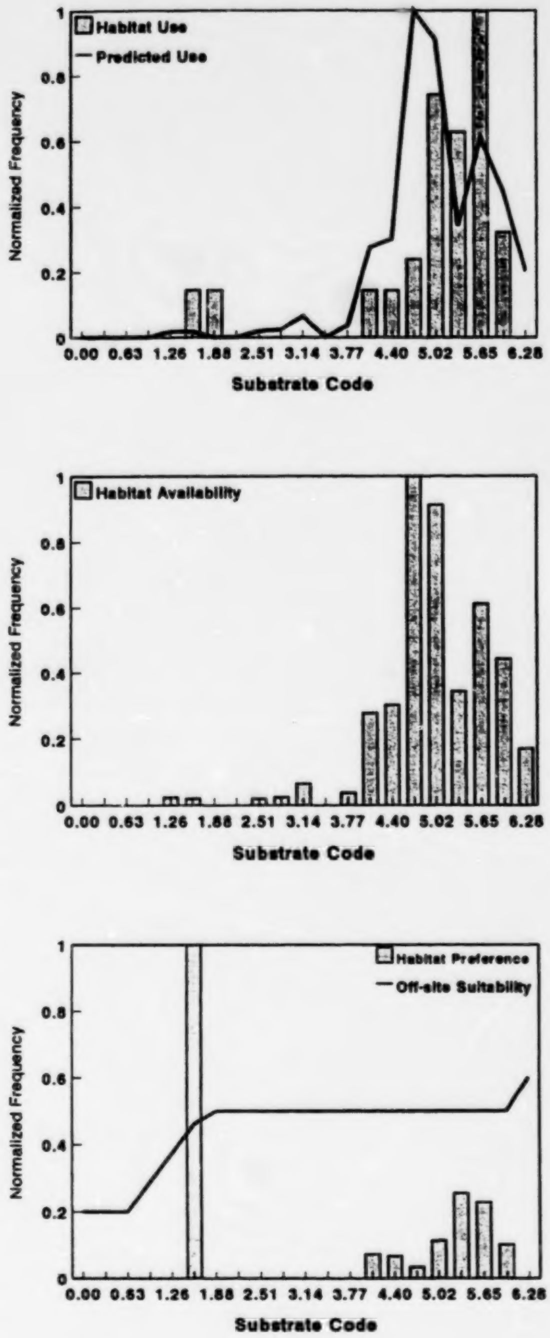


Figure 32 **Transferability analysis for walleye adult substrate preference, Red Deer River.**

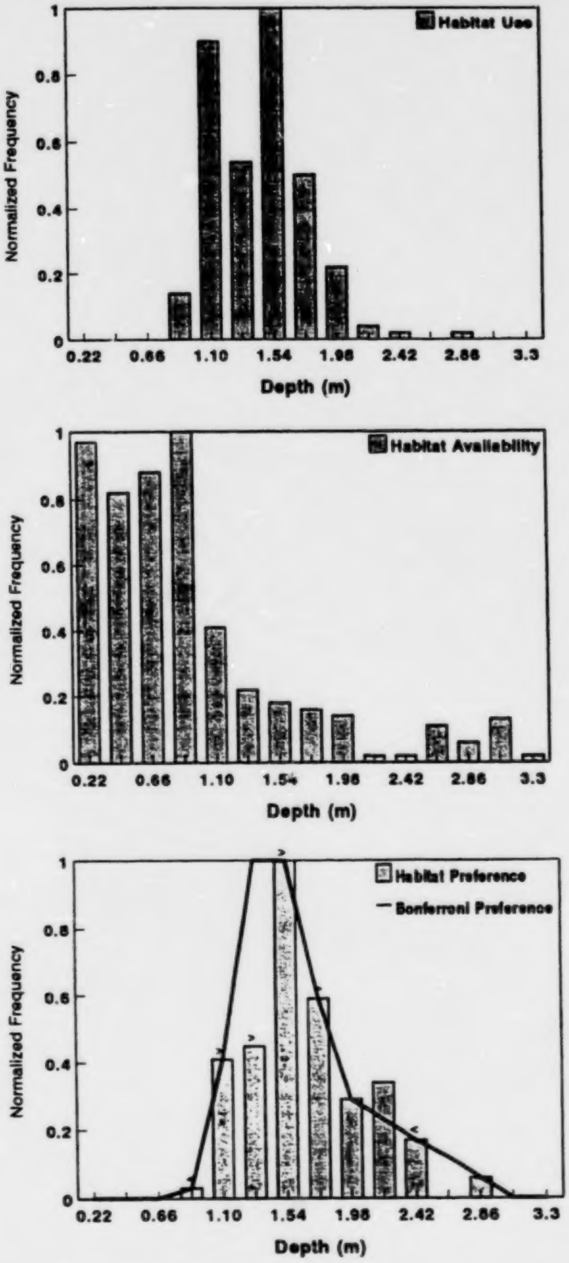


Figure 33 Mountain whitefish adult habitat preference for depth, Red Deer River.

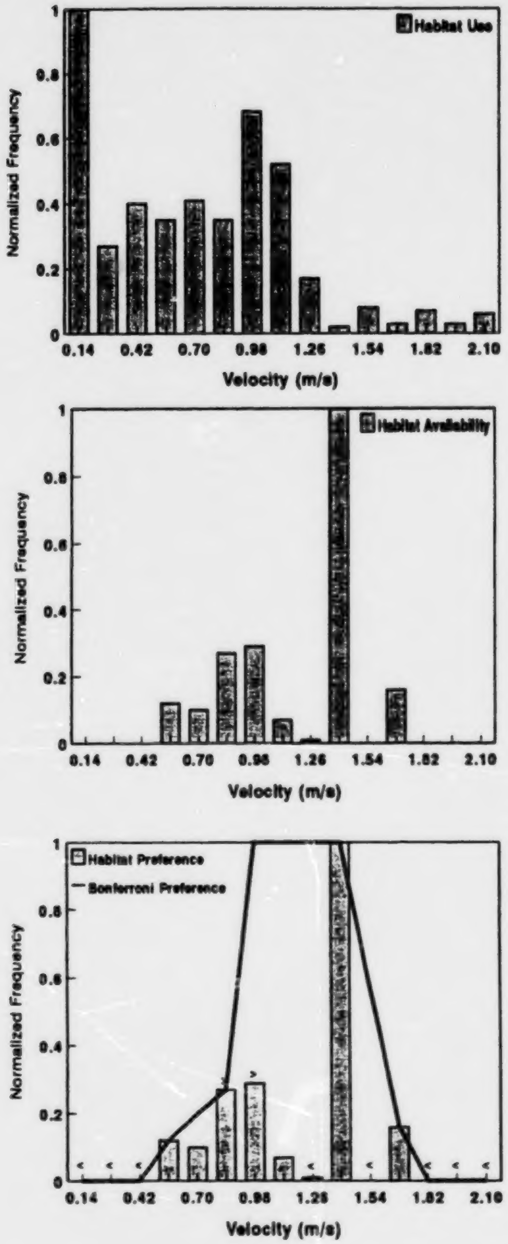


Figure 34 Mountain whitefish adult habitat preference for velocity, Red Deer River.

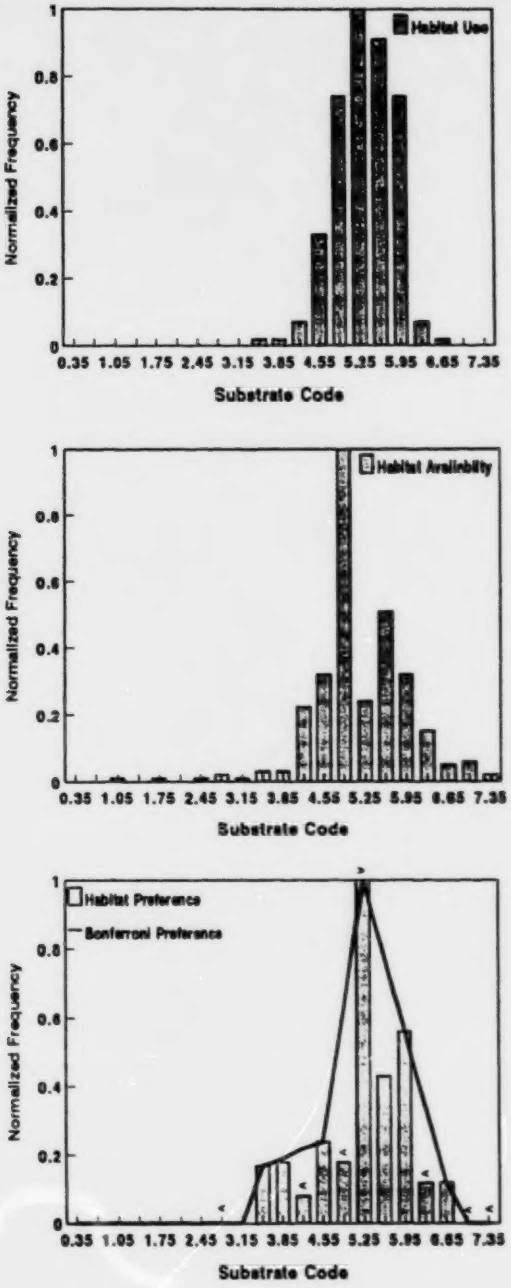


Figure 35 Mountain whitefish adult habitat preference for substrate, Red Deer River.

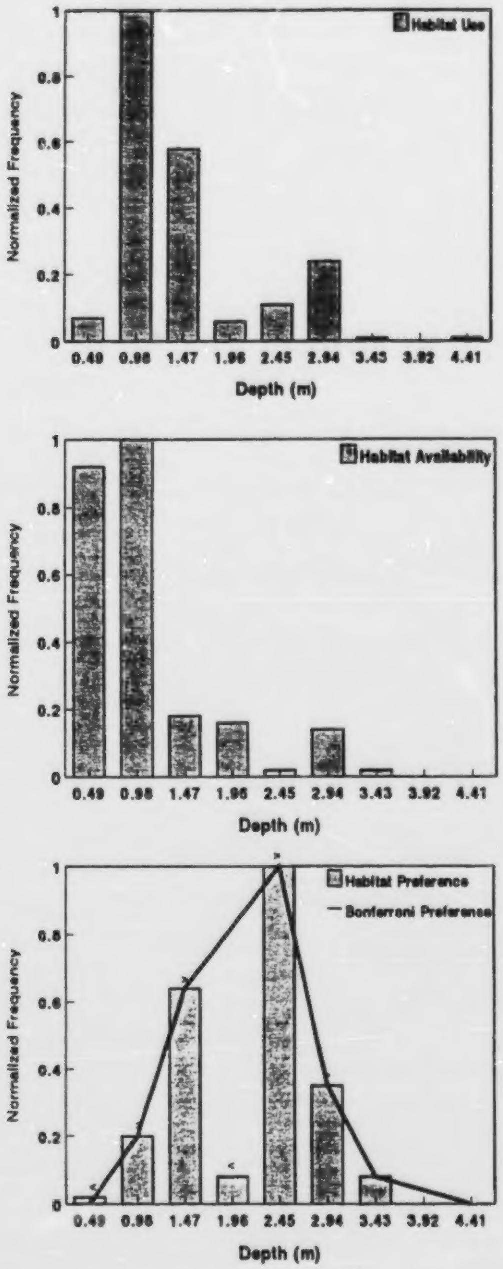


Figure 36 Mountain whitefish spawning habitat preference for depth, Red Deer River.

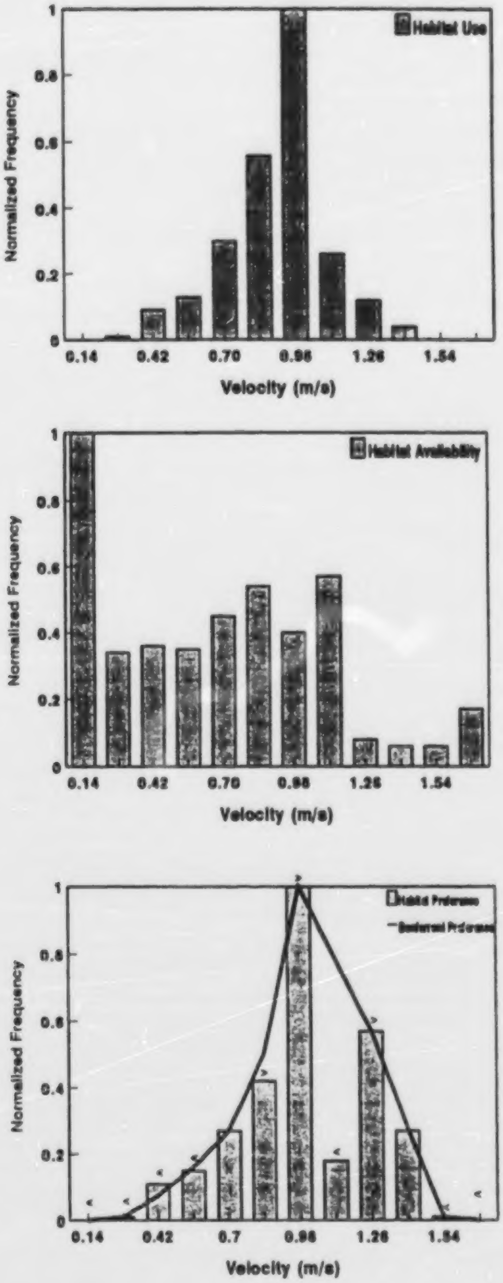


Figure 37 Mountain whitefish spawning habitat preference for velocity, Red Deer River.

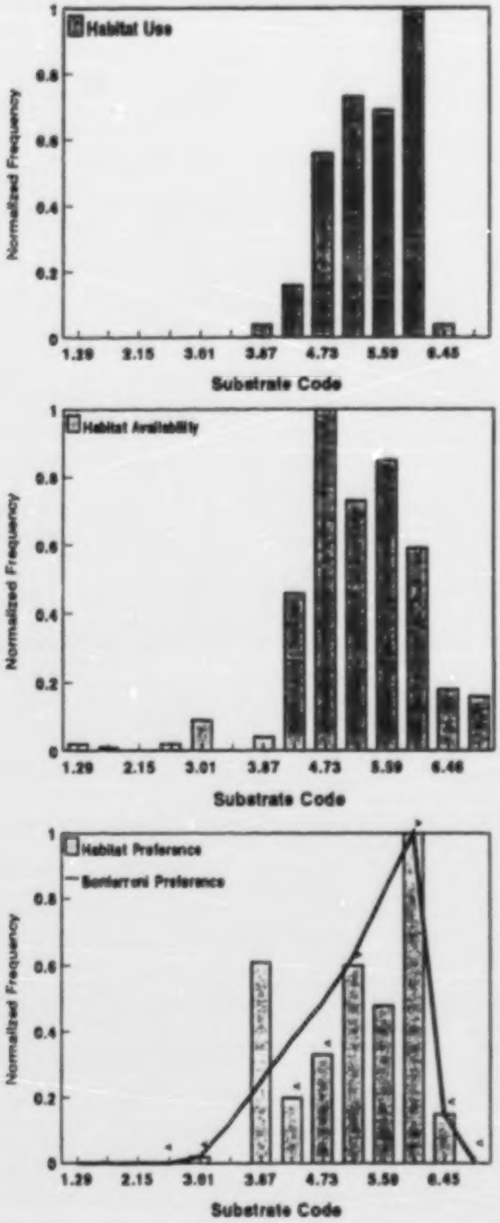


Figure 38 Mountain whitefish spawning habitat preference for substrate, Red Deer River.

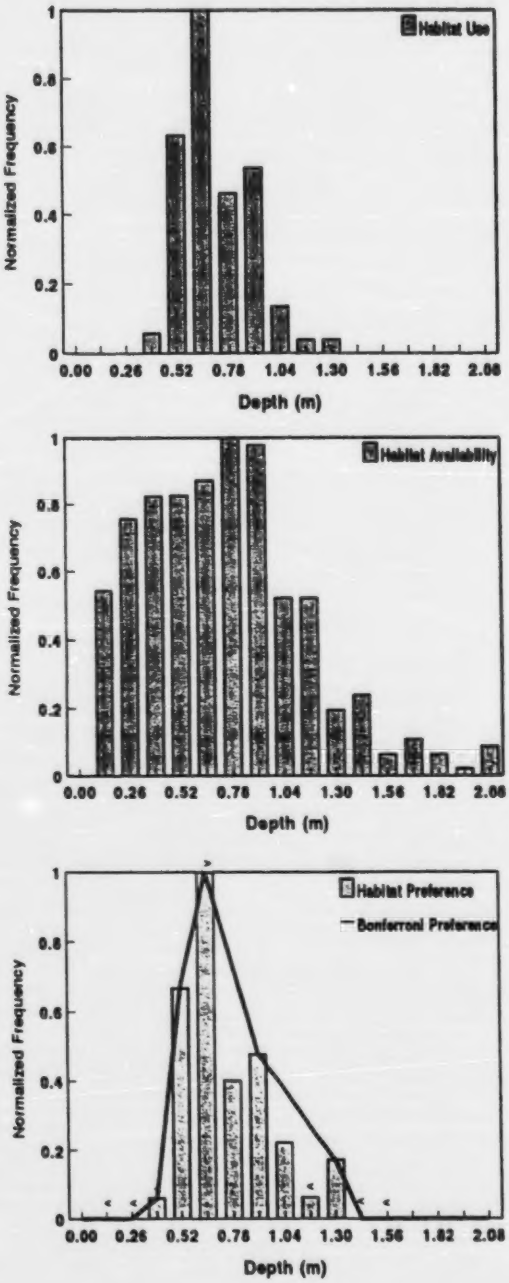


Figure 39 Walleye fry habitat preference for depth, Red Deer River.

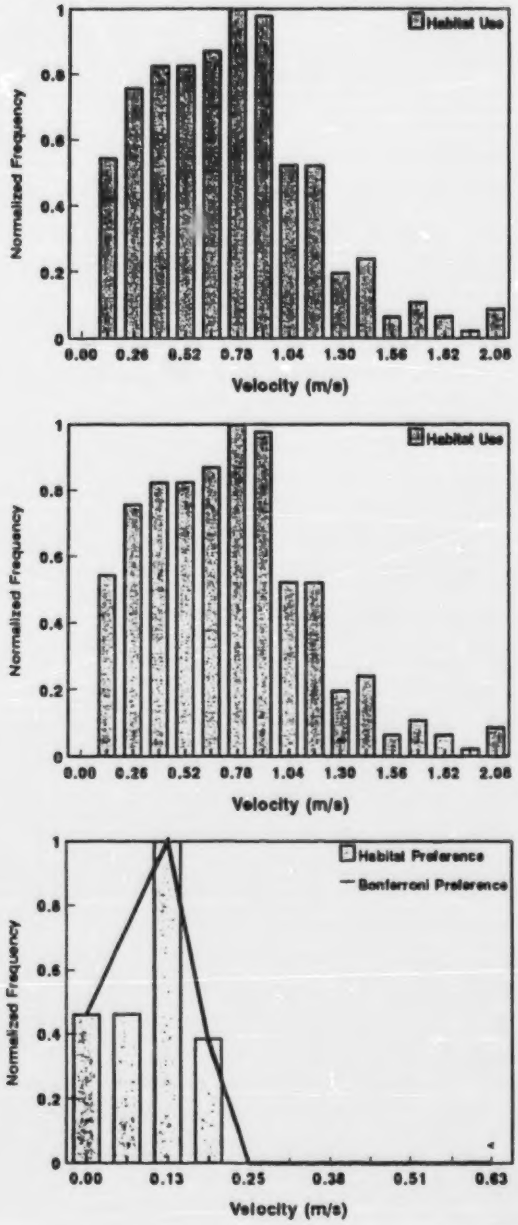


Figure 40 Walleye fry habitat preference for velocity, Red Deer River.

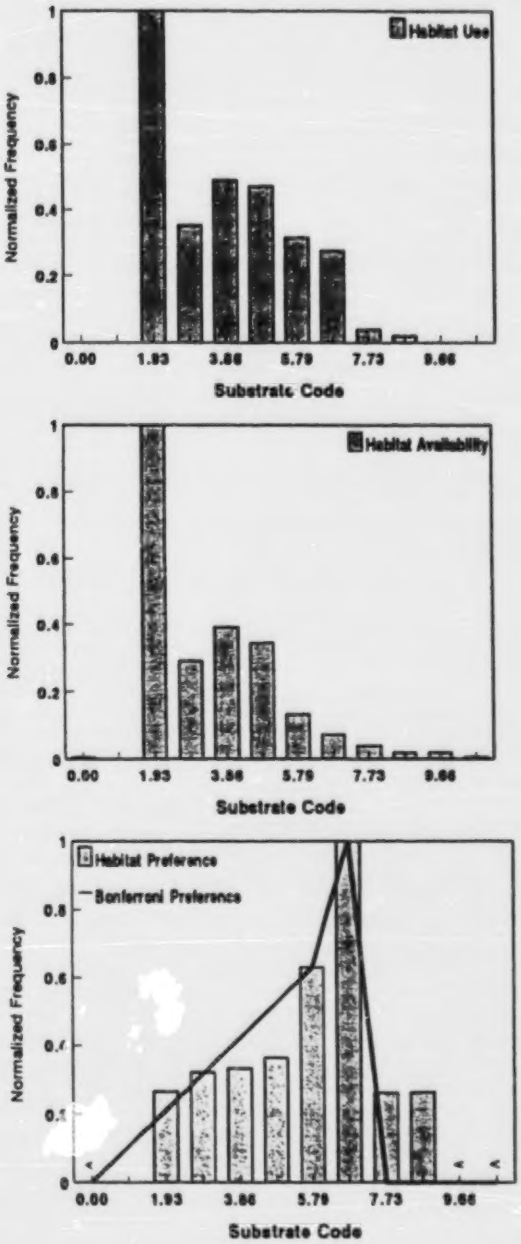


Figure 41 Walleye fry habitat preference for substrate, Red Deer River.

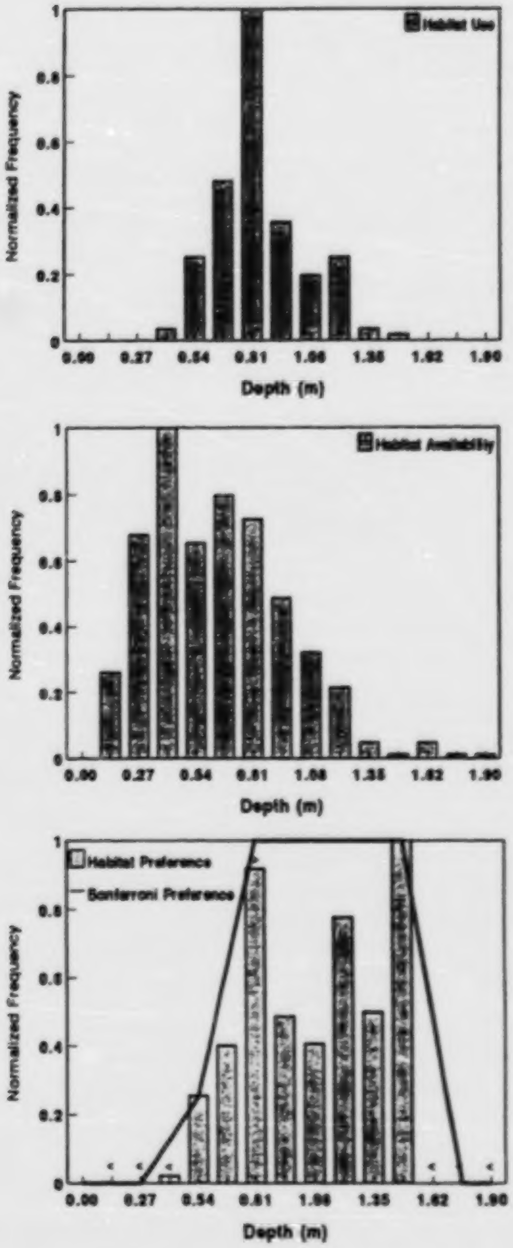


Figure 42 Walleye spawning habitat preference for depth, Red Deer River.

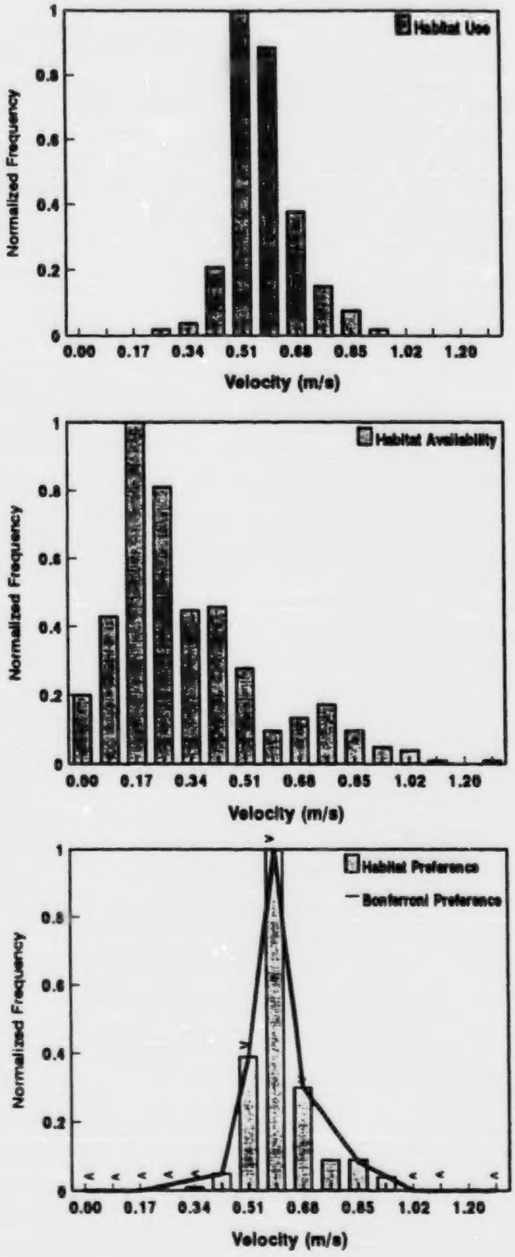


Figure 43 Walleye spawning habitat preference for velocity, Red Deer River.

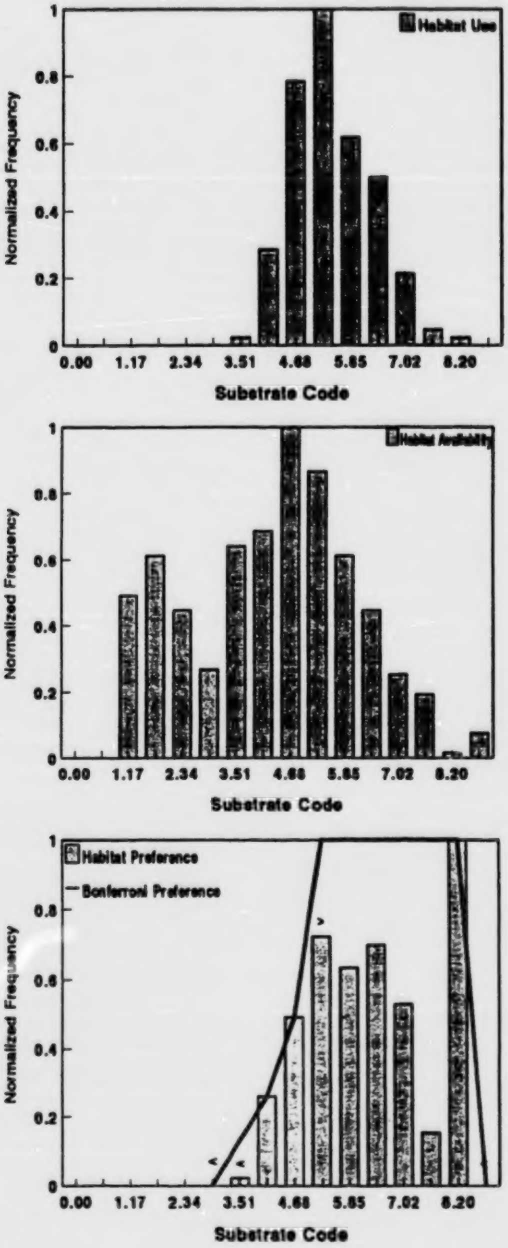


Figure 44 Walleye spawning habitat preference for substrate, Red Deer River.

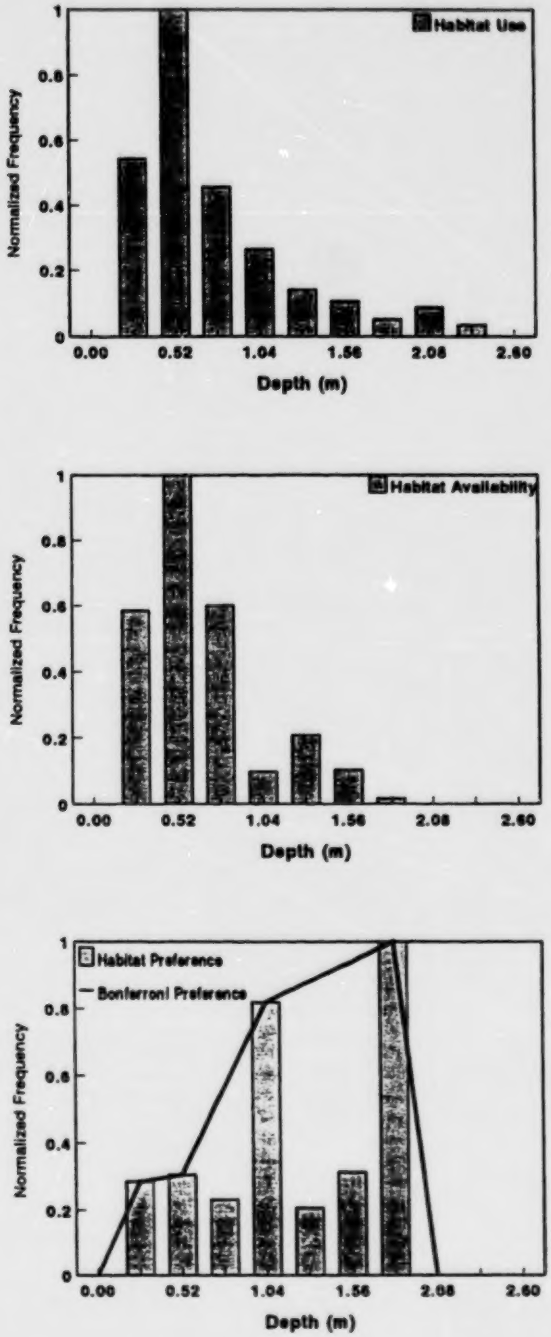


Figure 45 Goldeye fry habitat preference for depth, Red Deer River.

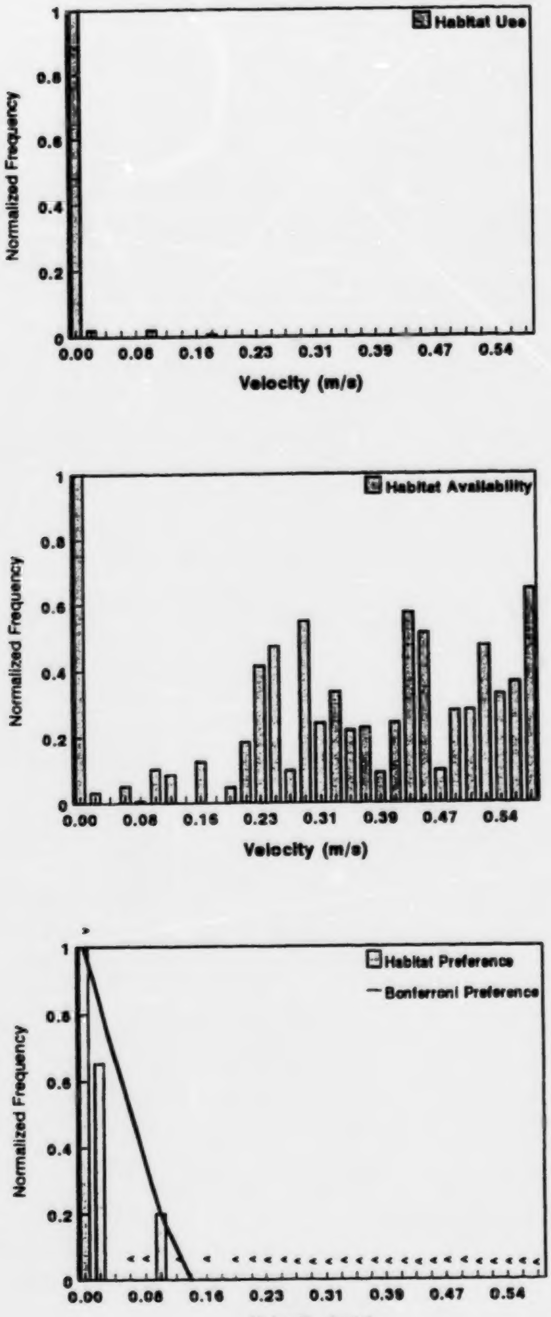


Figure 46 Goldeye fry habitat preference for velocity, Red Deer River.

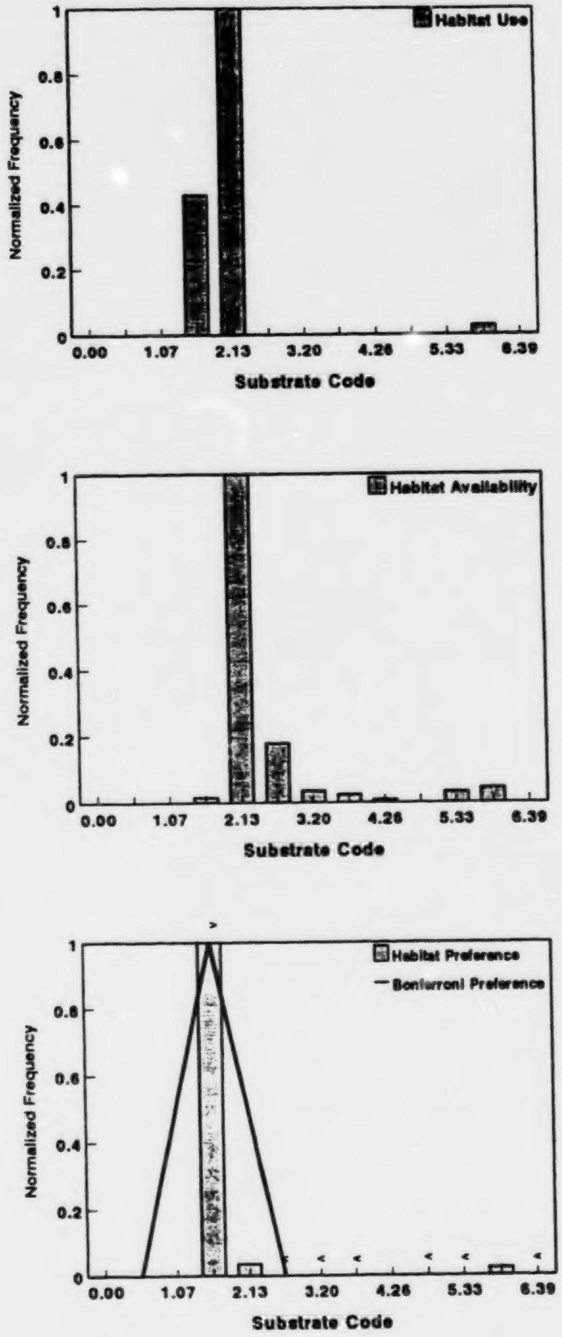


Figure 47 Goldeye fry habitat preference for substrate, Red Deer River.

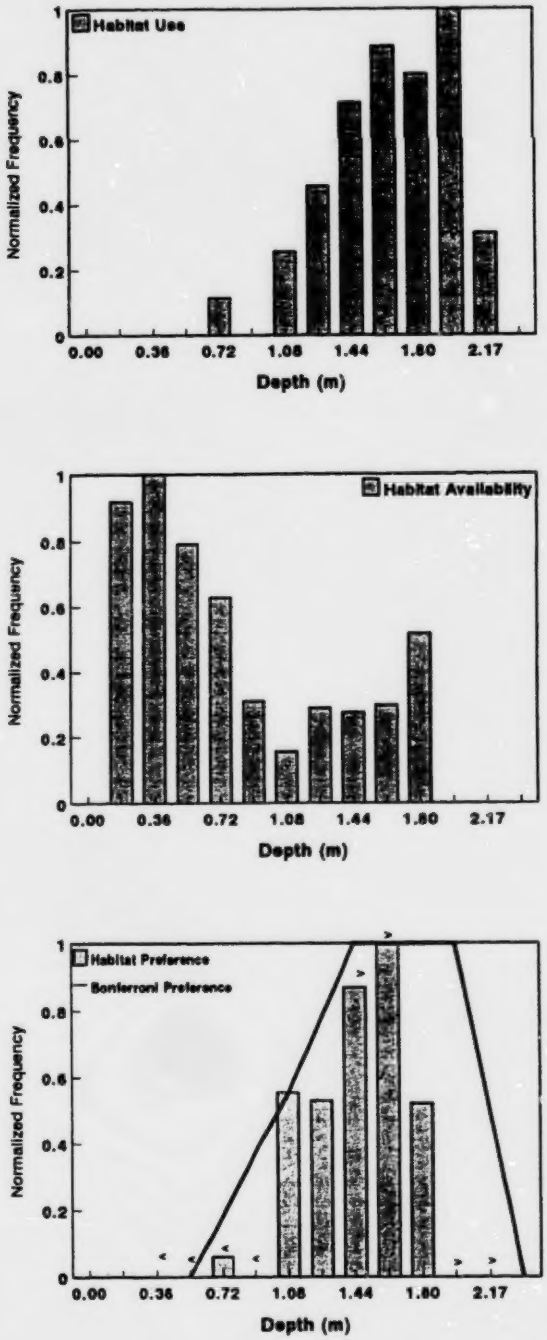


Figure 48 Goldeye juvenile habitat preference for depth, Red Deer River.

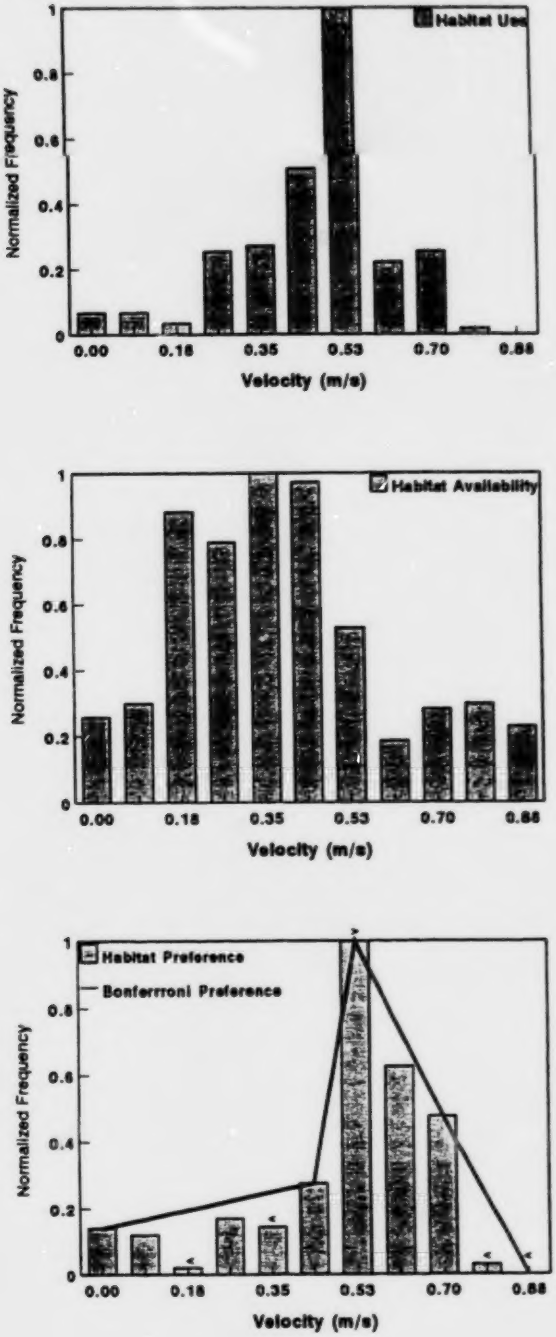


Figure 49 Goldeye juvenile habitat preference for velocity, Red Deer River.

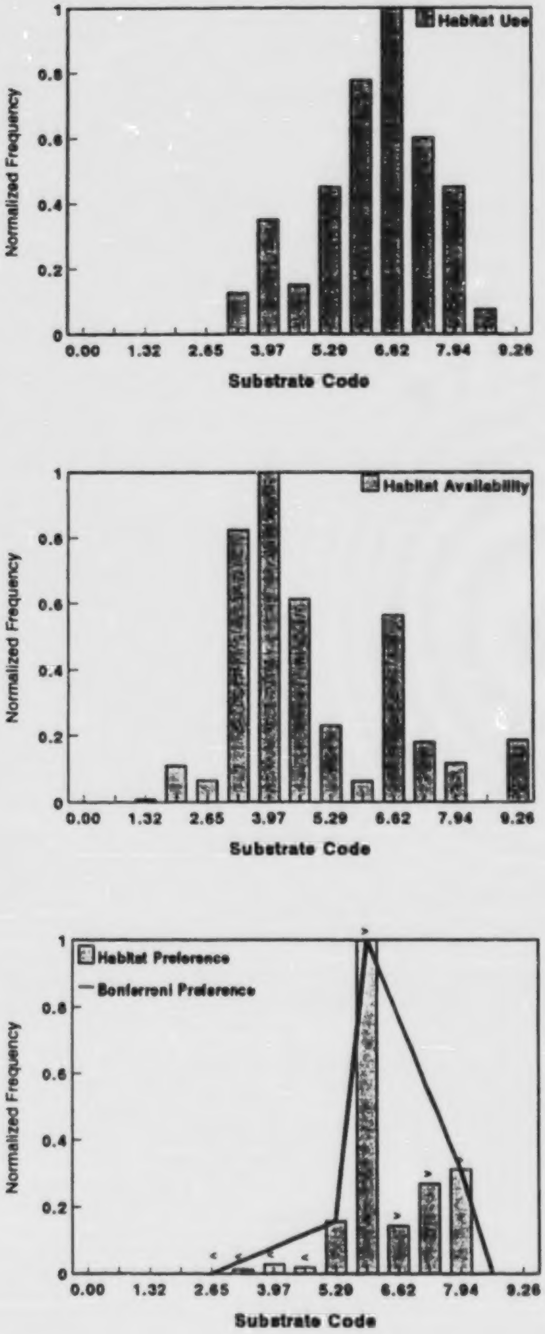


Figure 50 Goldeye juvenile habitat preference for substrate, Red Deer River.

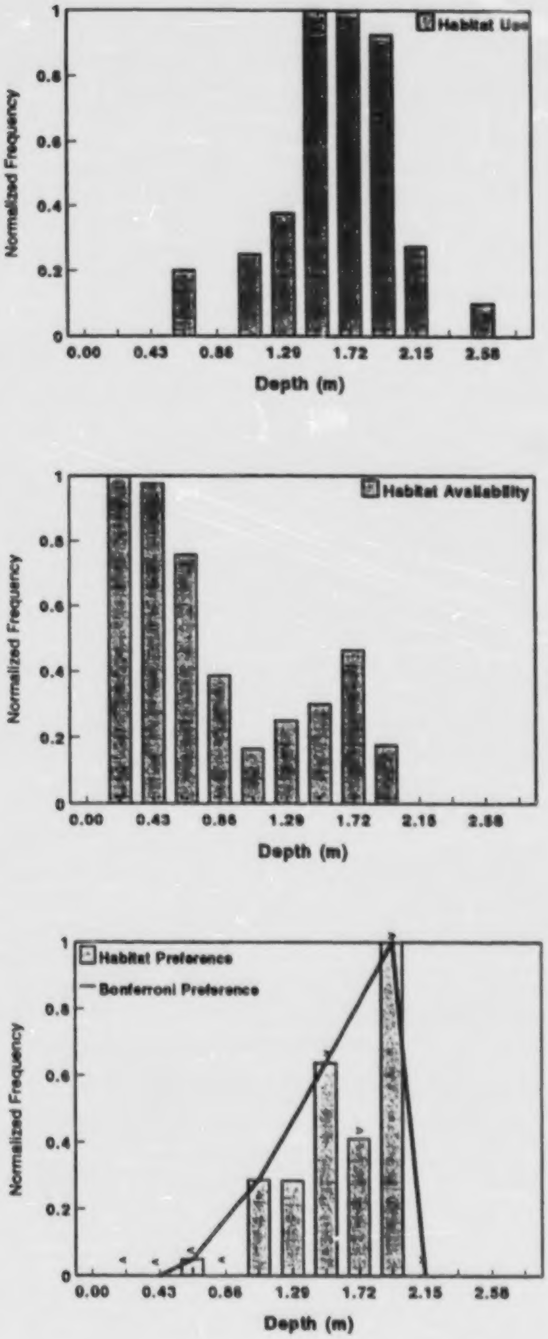


Figure 51 Goldeye adult habitat preference for depth, Red Deer River.

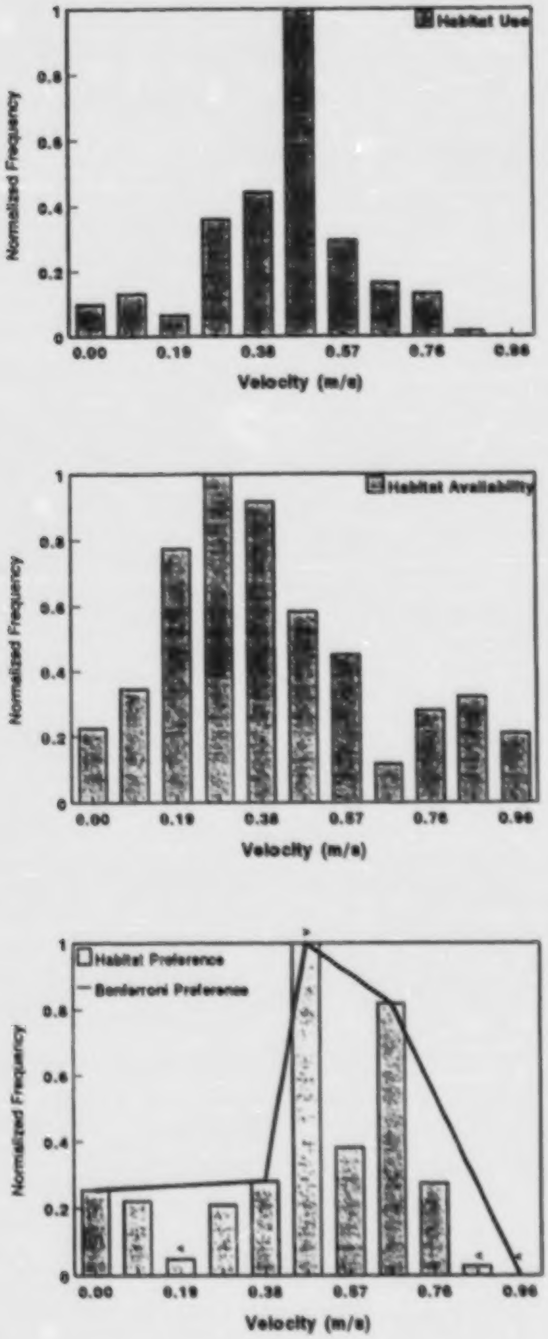


Figure 52 Goldeye adult habitat preference for velocity, Red Deer River.

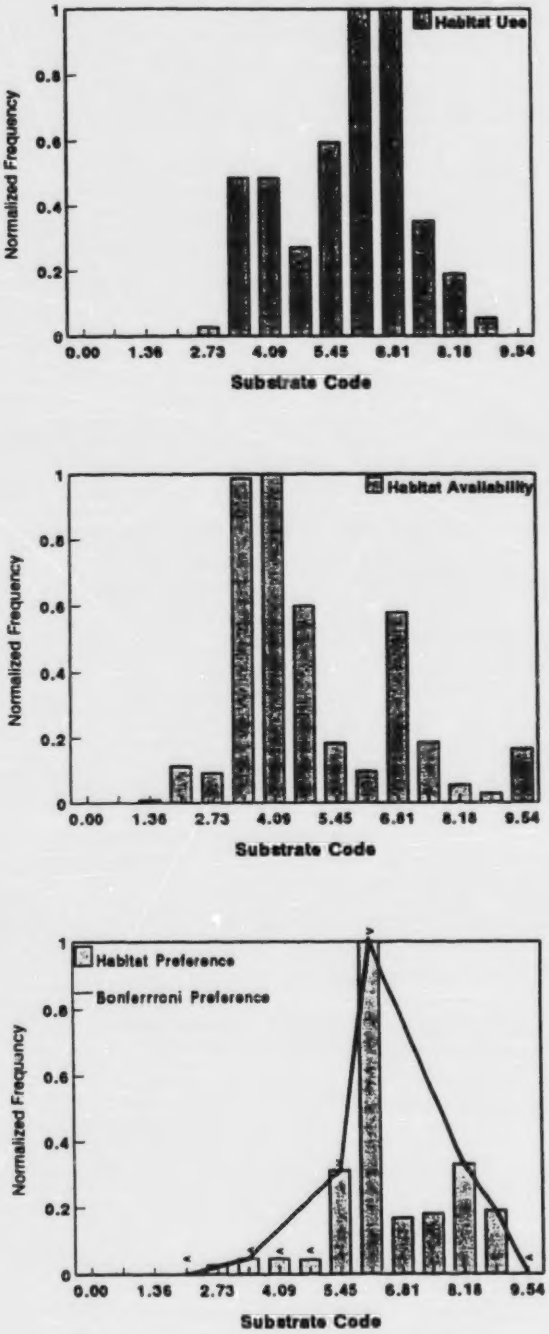


Figure 53 Goldeye adult habitat preference for substrate, Red Deer River.

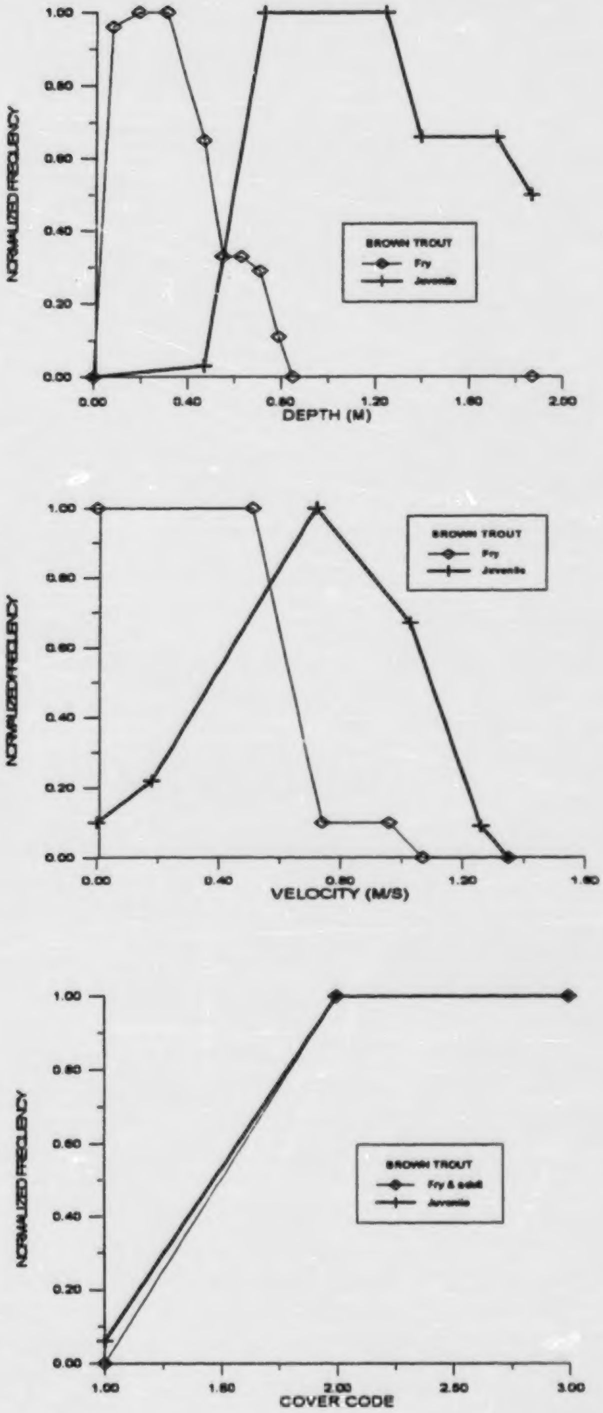


Figure 54. Normalized habitat preference curves for younger life stages of brown trout in the South Saskatchewan River drainage.

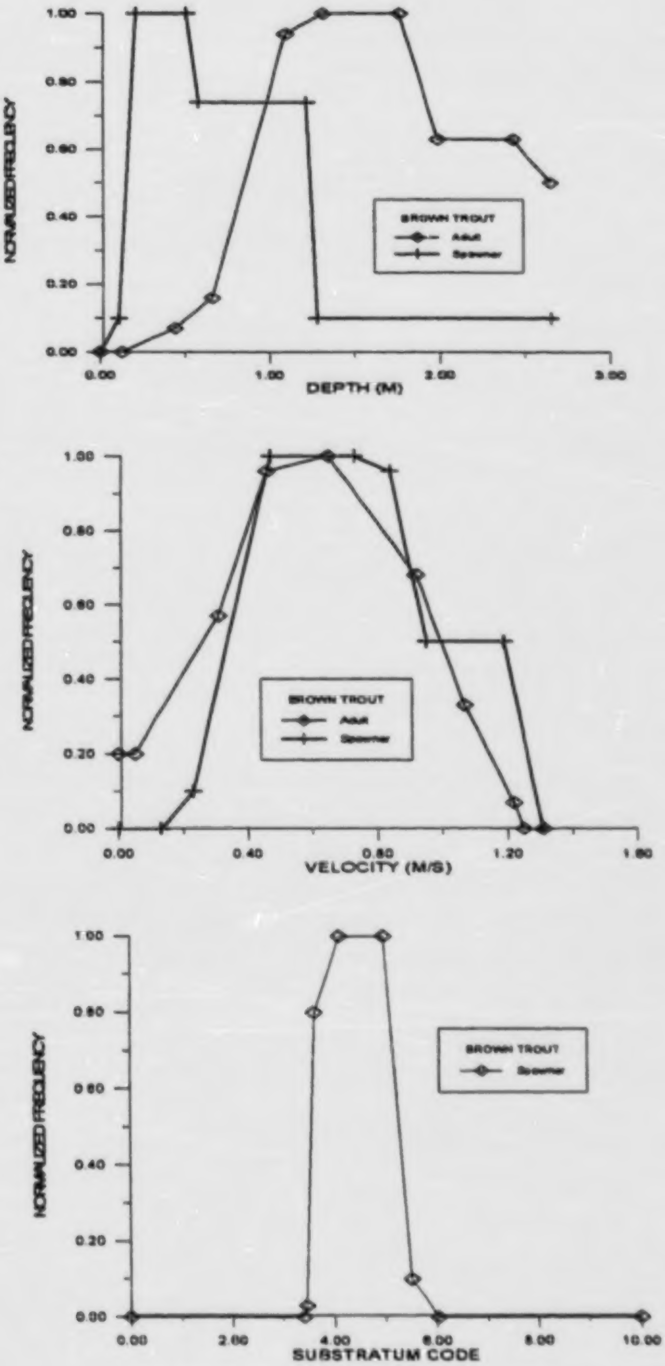


Figure 55. Normalized habitat preference curves for older life stages of brown trout in the South Saskatchewan River drainage.

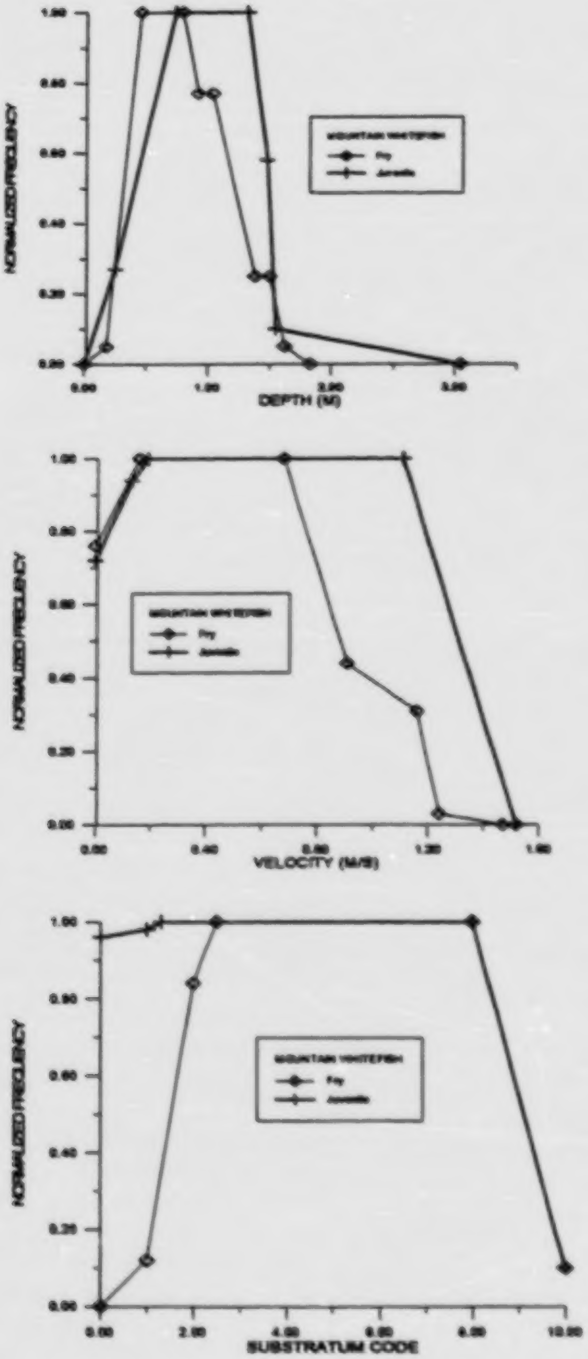


Figure 56. Normalized habitat preference curves for younger life stages of mountain whitefish in the South Saskatchewan River drainage.

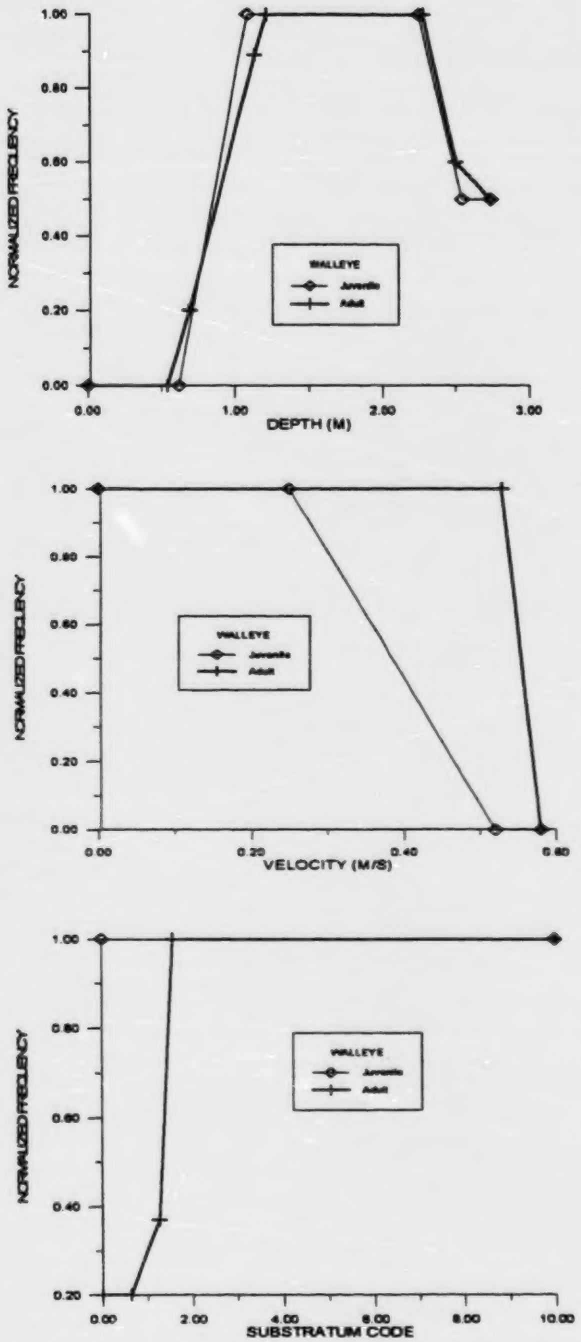


Figure 57. Normalized habitat preference curves for intermediate life stages of walleye in the South Saskatchewan River drainage.

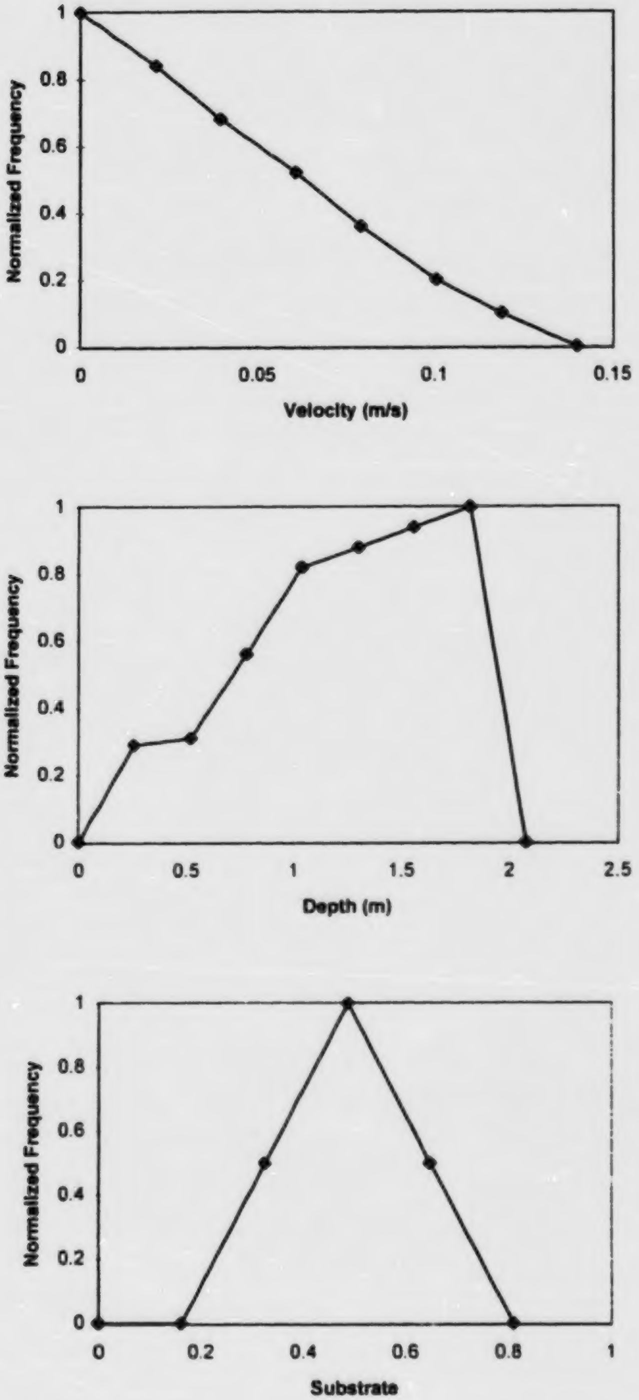


Figure 58 Final Habitat Preference Criteria for Goldeye Fry Used in the Red Deer River Instream Flow Needs Analysis

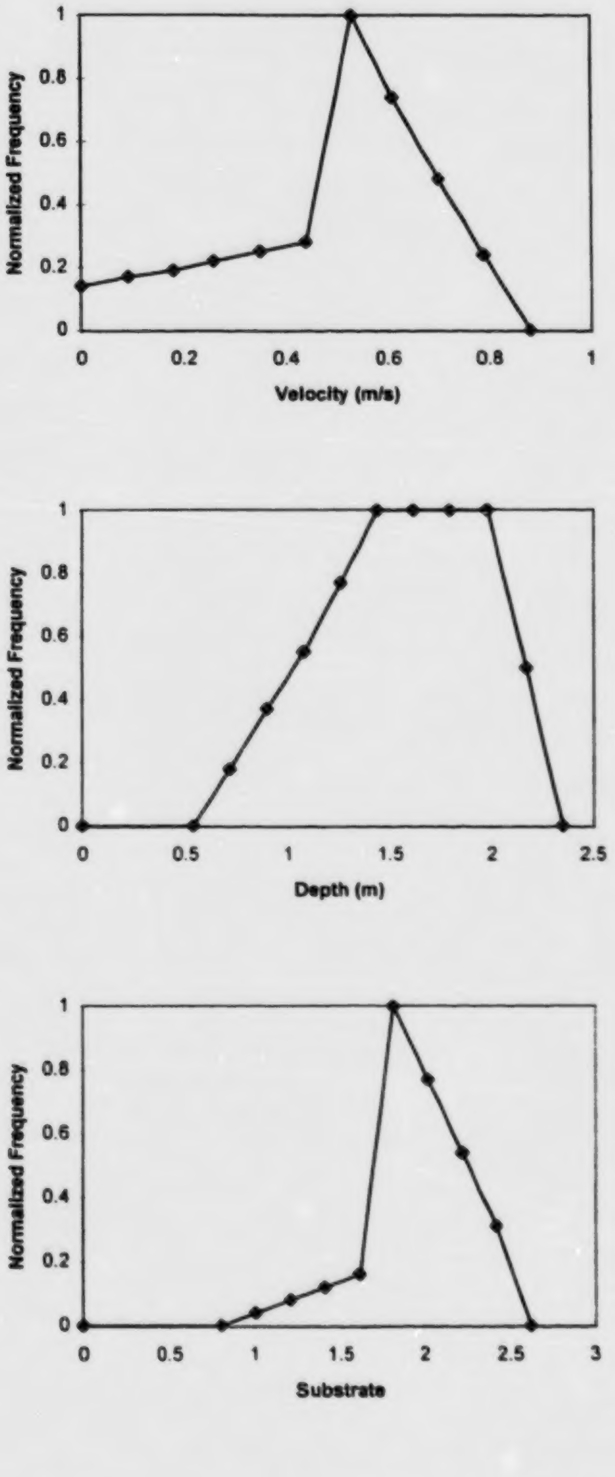


Figure 59 Final Habitat Preference Criteria for Goldeye Juveniles Used in the Red Deer River Instream Flow Needs Analysis

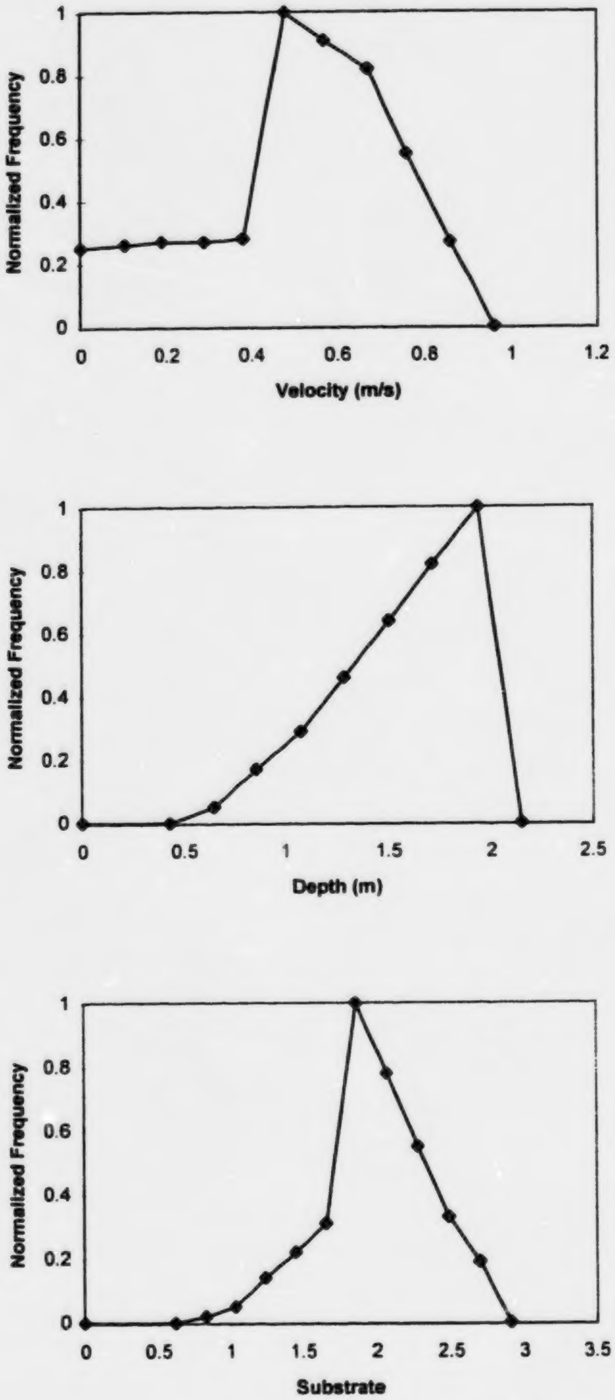


Figure 60 **Final Habitat Preference Criteria for Goldeye Adults Used in the Red Deer River Instream Flow Needs Analysis**

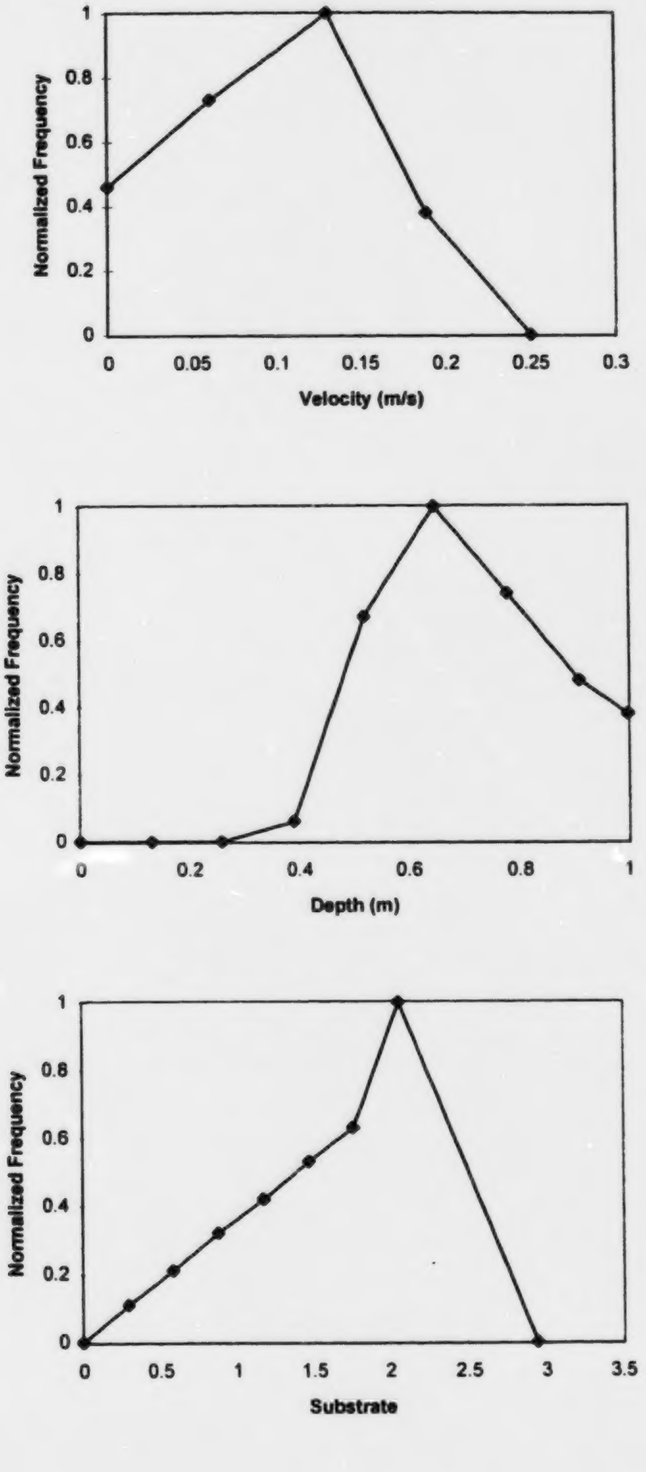


Figure 61 Final Habitat Preference Criteria for Walleye Fry Used in the Red Deer River Instream Flow Needs Analysis

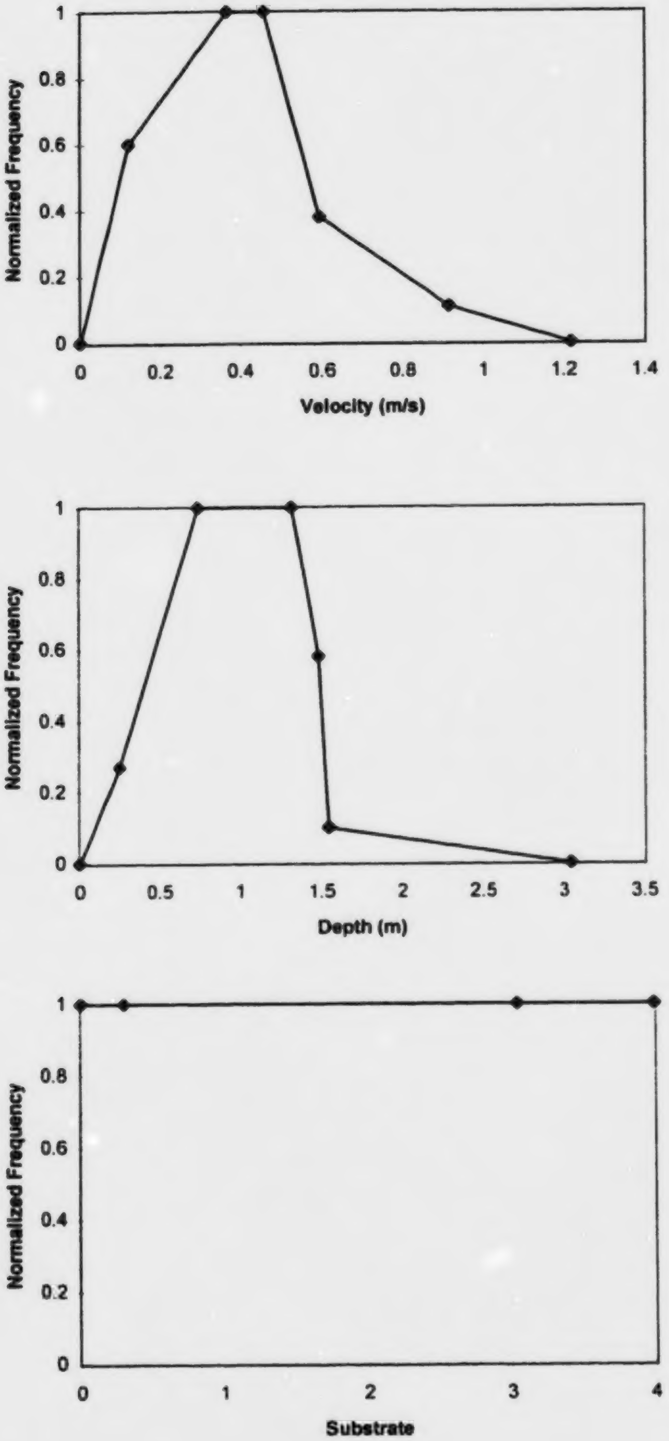


Figure 62 Final Habitat Preference Criteria for Walleye Juveniles Used in the Red Deer River Instream Flow Needs Analysis

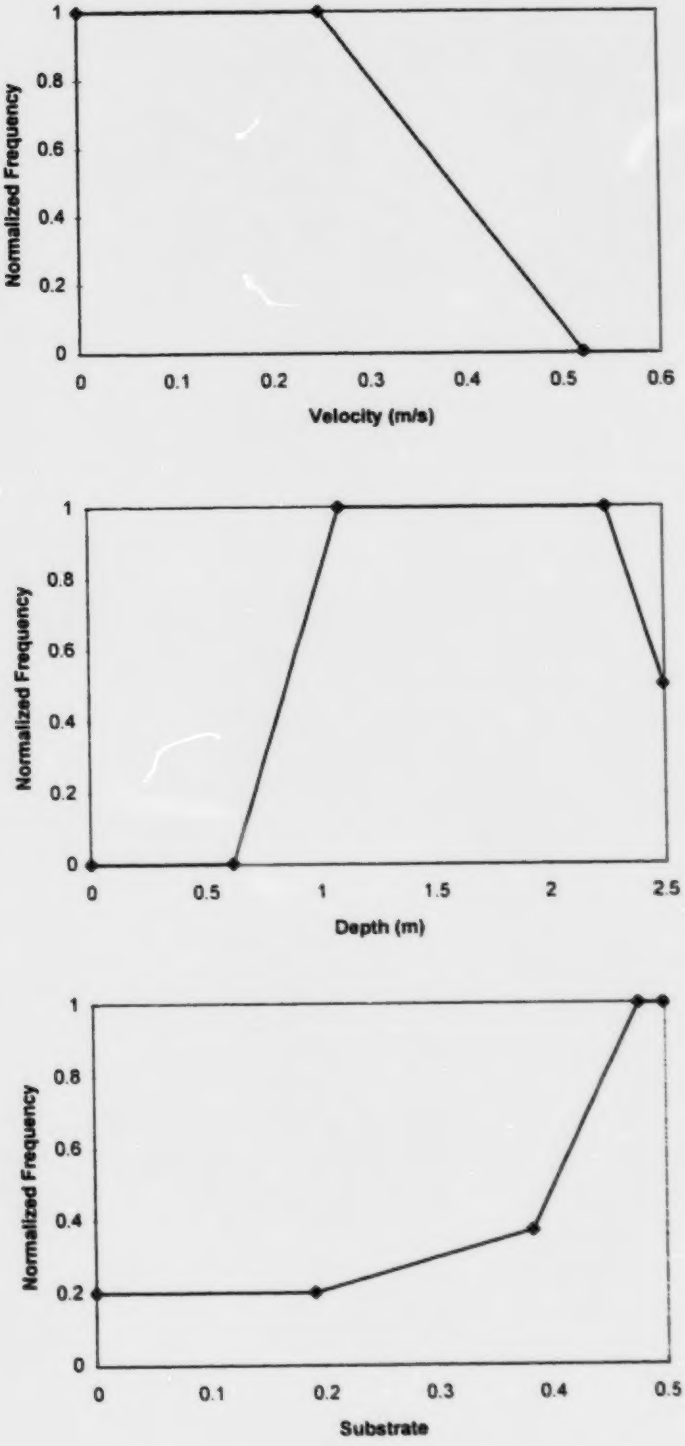


Figure 63 Final Habitat Preference Criteria for Walleye Adults Used in the Red Deer River Instream Flow Needs Analysis

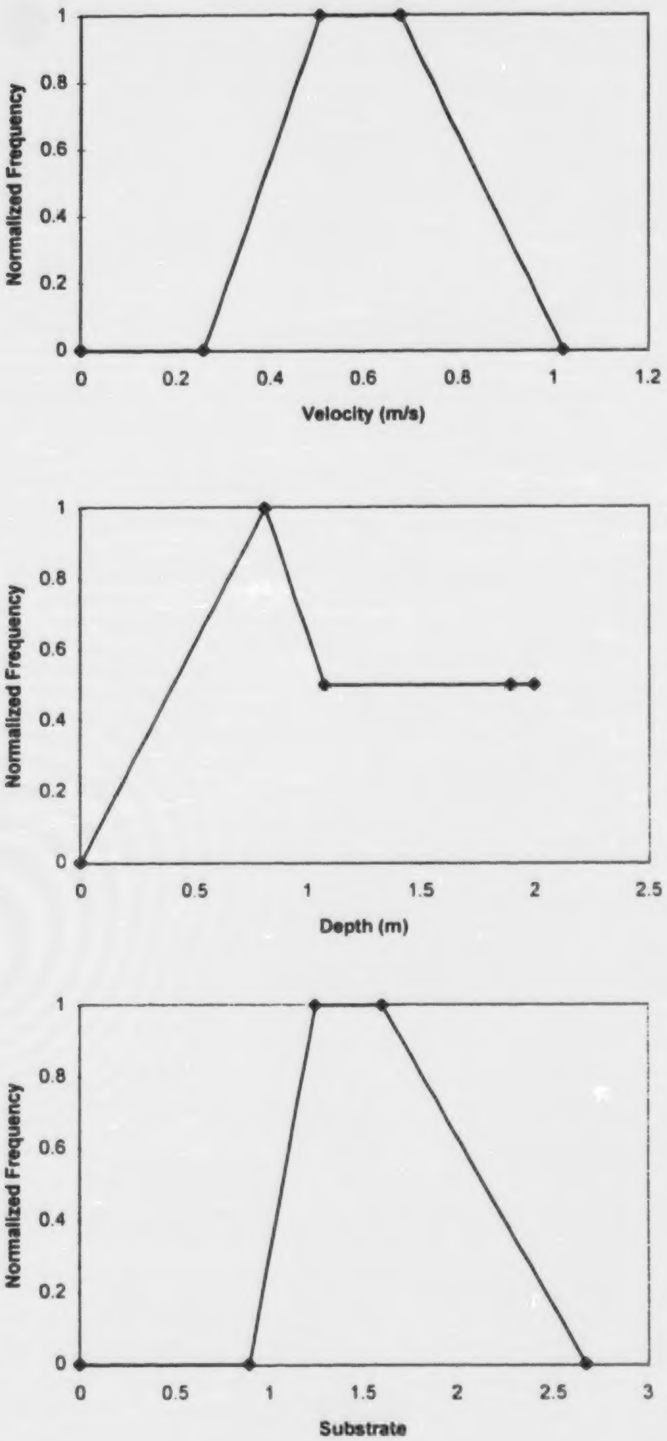


Figure 64 **Final Habitat Preference Criteria for Walleye Spawning Used in the Red Deer River Instream Flow Needs Analysis**

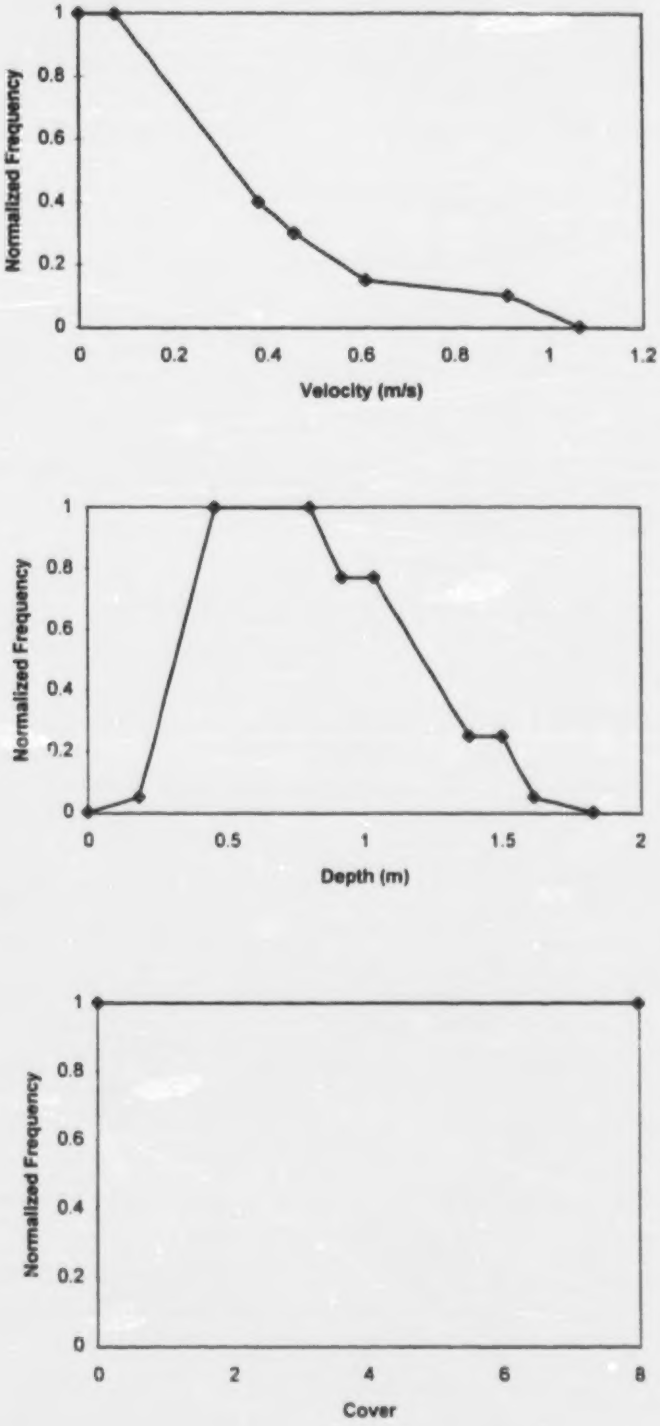


Figure 65 Final Habitat Preference Criteria for Mountain Whitefish Fry Used in the Red Deer River Instream Flow Needs Analysis

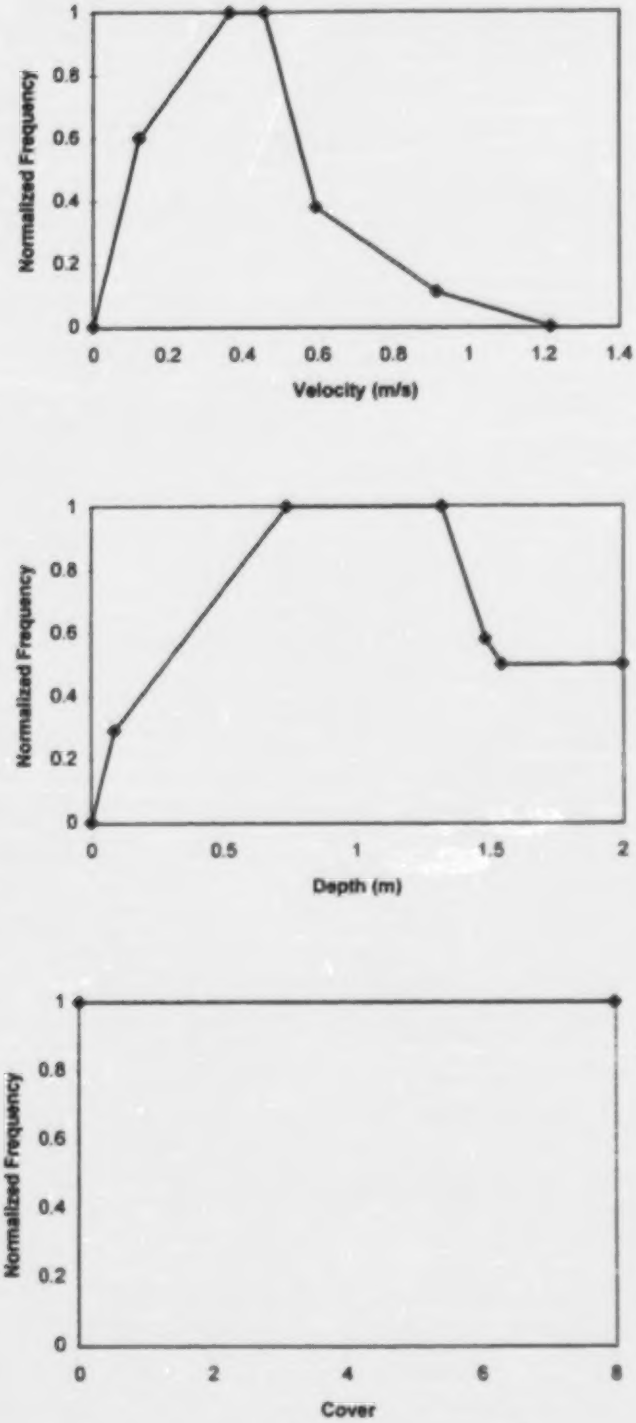


Figure 66 Final Habitat Preference Criteria for Mountain Whitefish Juveniles Used in the Red Deer River Instream Flow Needs Analysis

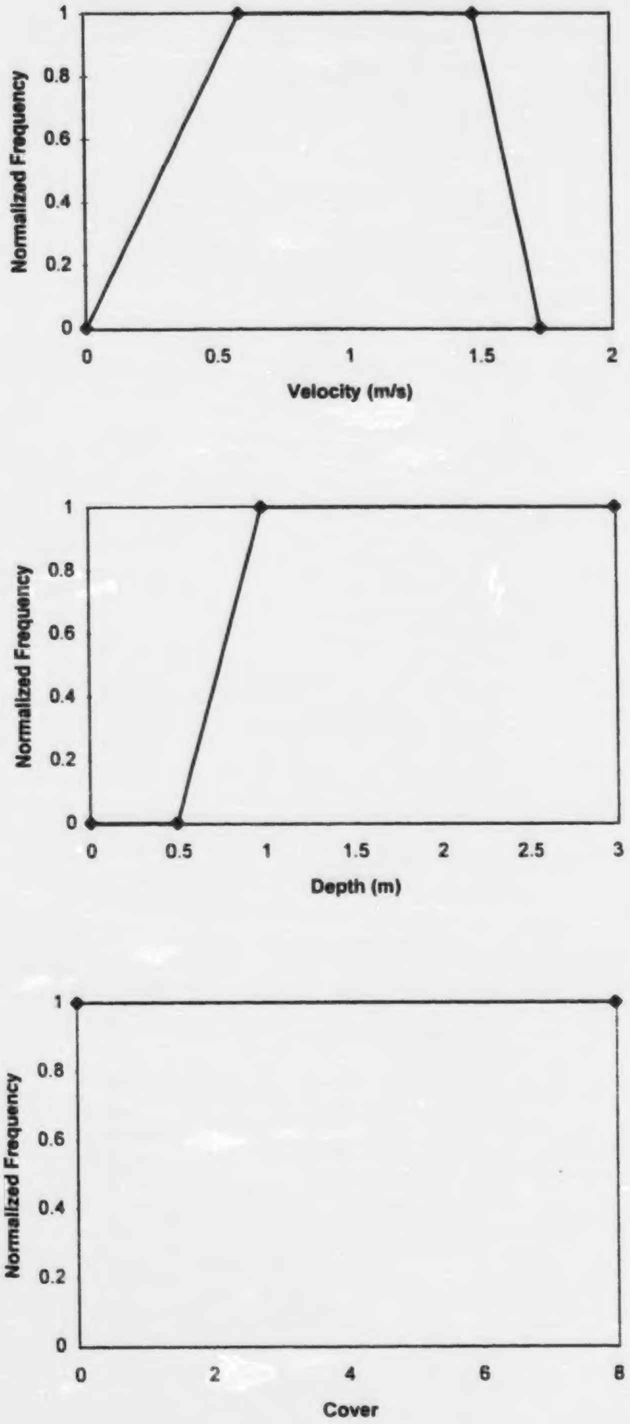


Figure 67 Final Habitat Preference Criteria for Mountain Whitefish Adults Used in the Red Deer River Instream Flow Needs Analysis

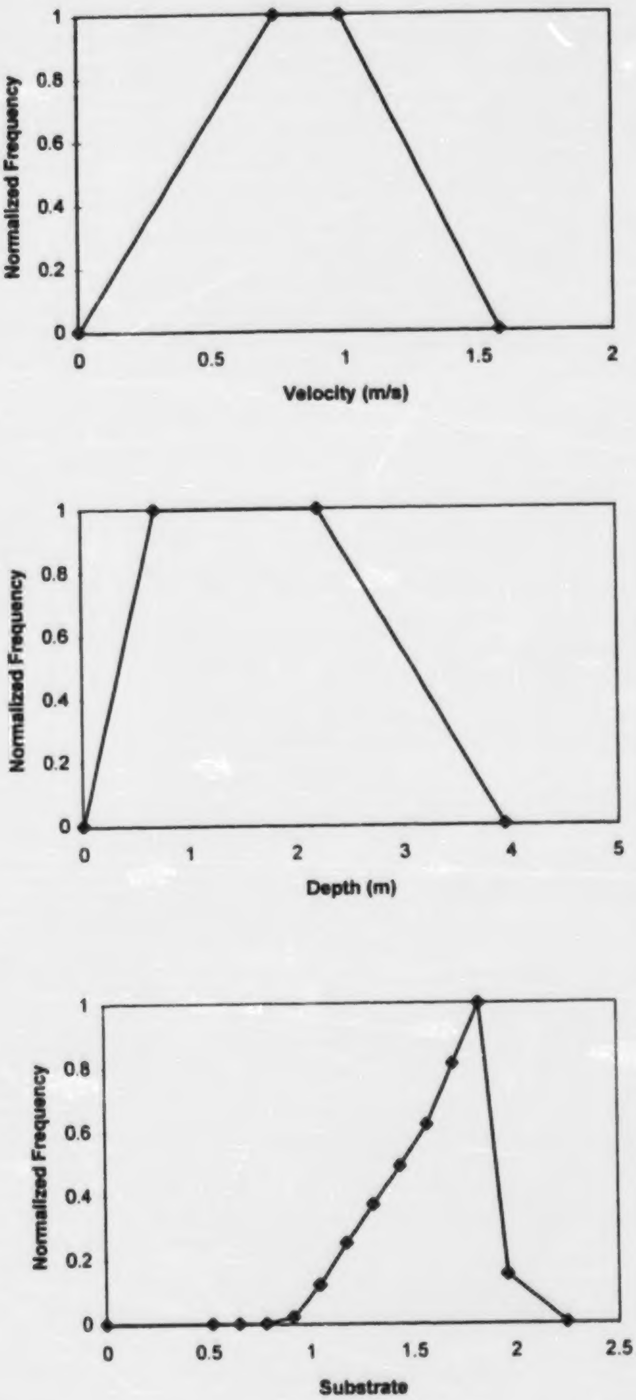


Figure 68 Final Habitat Preference Criteria for Mountain Whitefish Spawning Used in the Red Deer River Instream Flow Needs Analysis

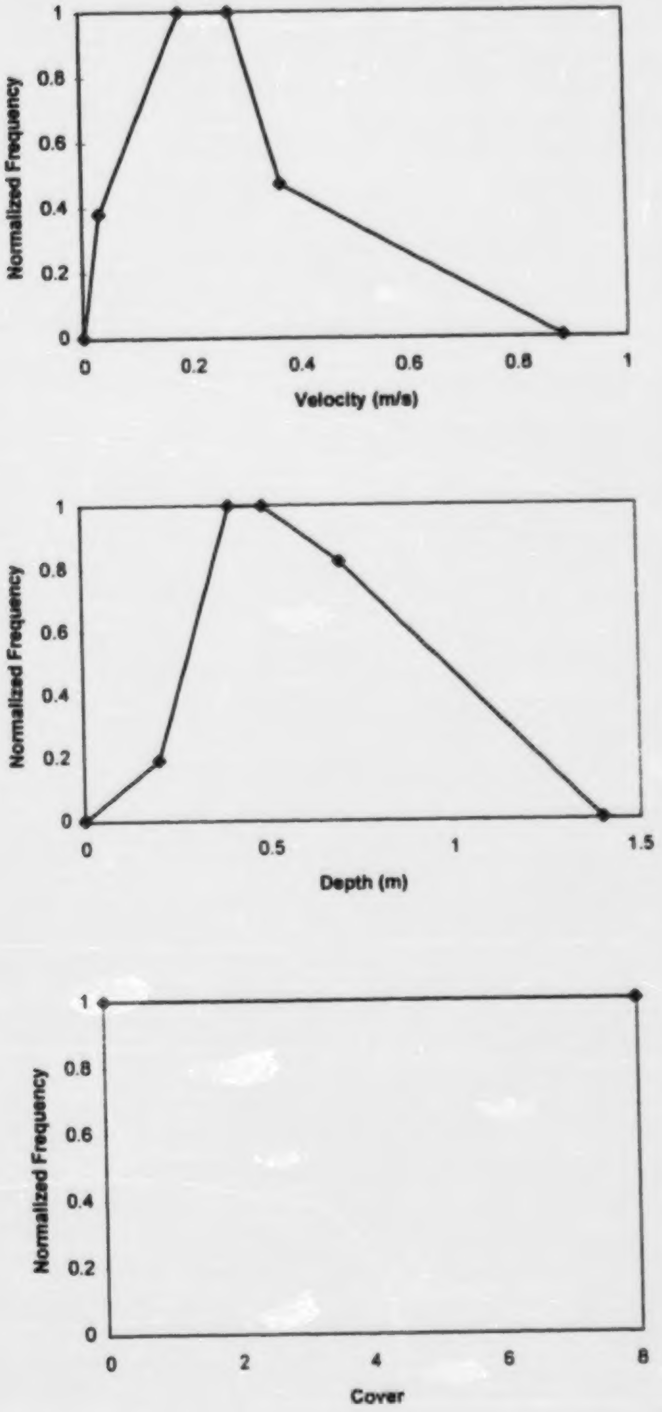


Figure 69 Final Habitat Preference Criteria for Brown Trout Fry Used in the Red Deer River Instream Flow Needs Analysis

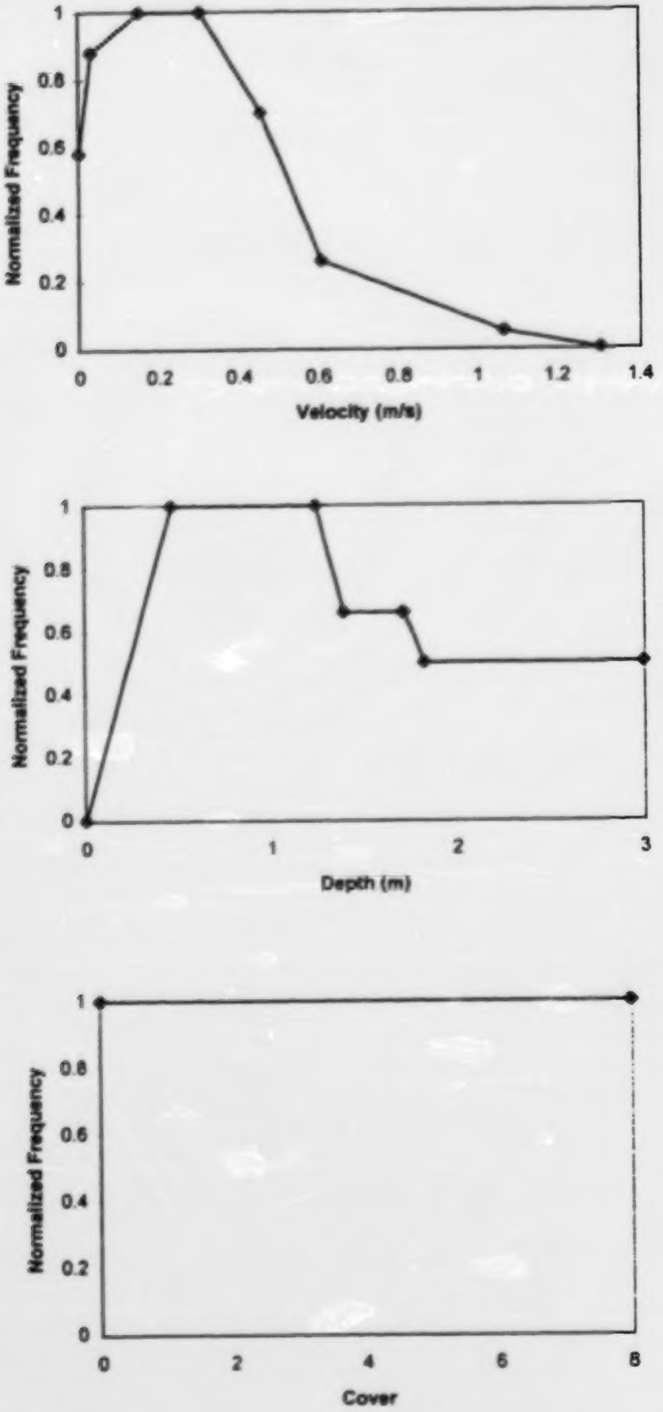


Figure 70 Final Habitat Preference Criteria for Brown Trout Juveniles Used in the Red Deer River Instream Flow Needs Analysis

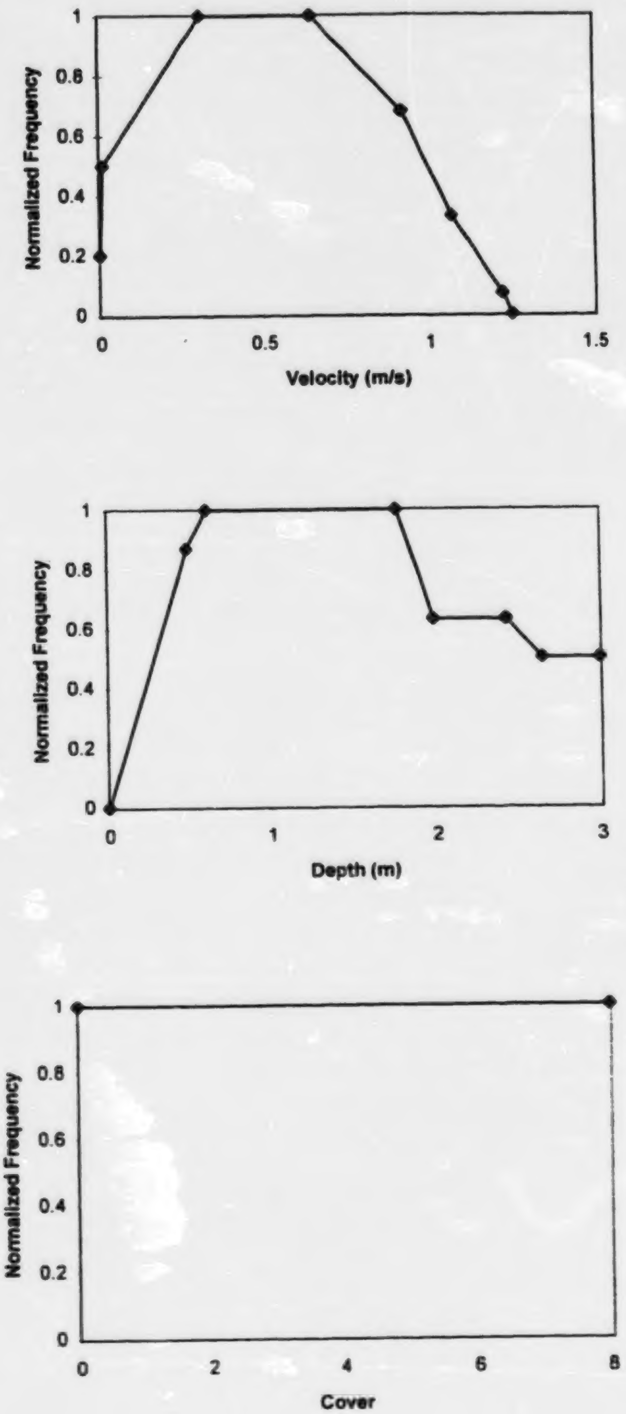


Figure 71 Final Habitat Preference Criteria for Brown Trout Adults Used in the Red Deer River Instream Flow Needs Analysis

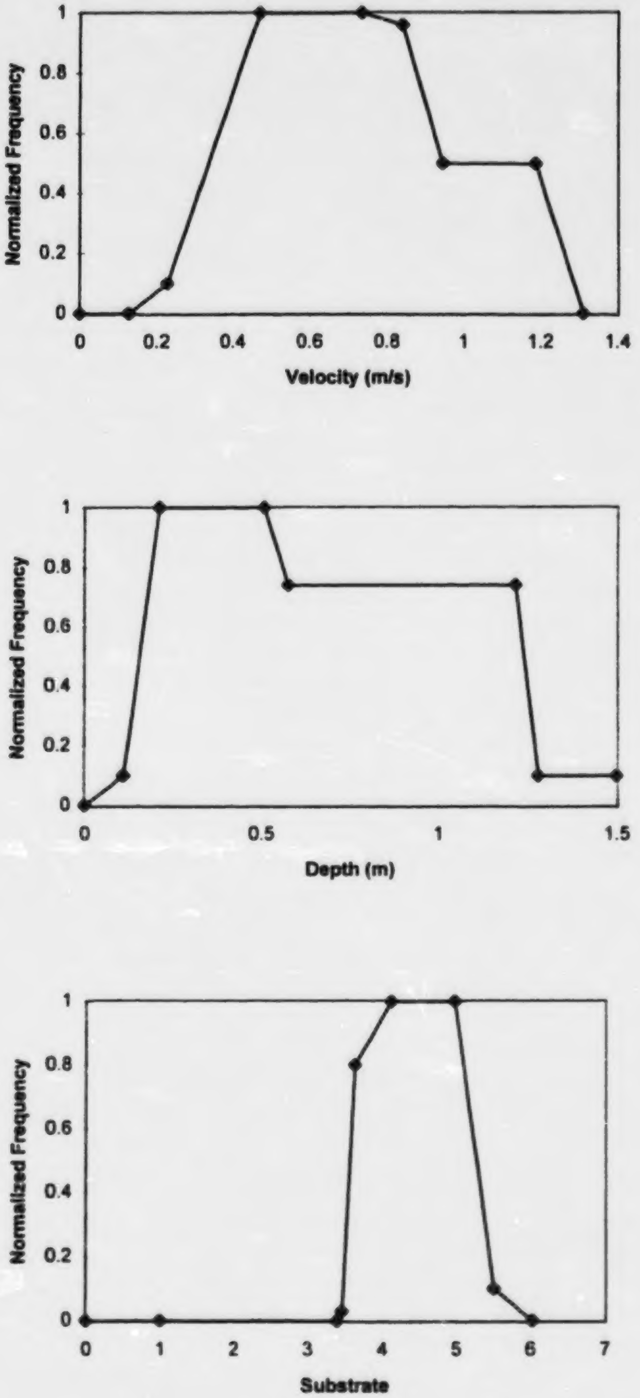
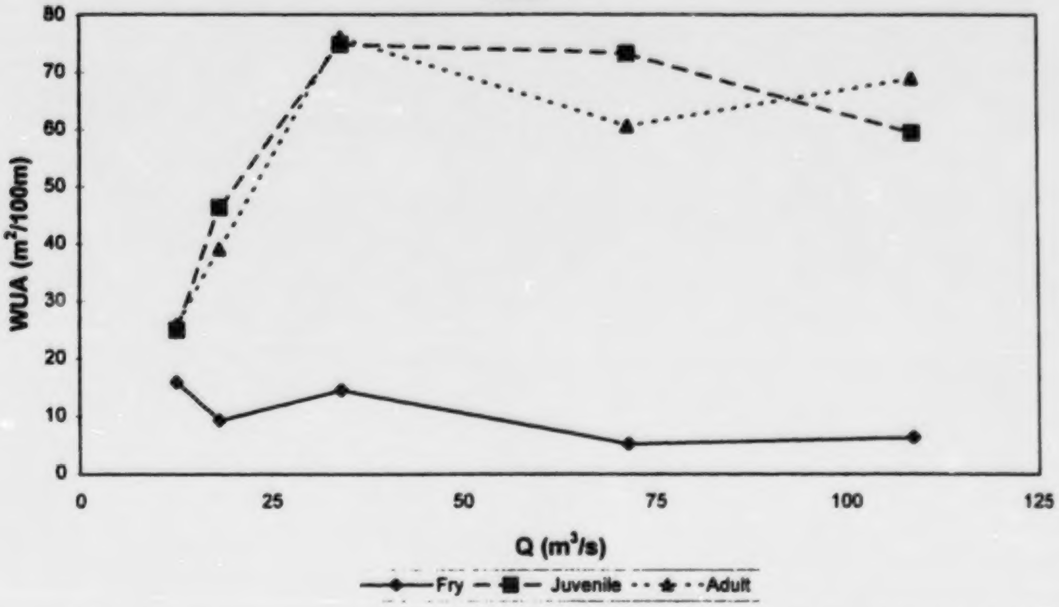


Figure 72 Final Habitat Preference Criteria for Brown Trout Spawning Used in the Red Deer River Instream Flow Needs Analysis

Reach 1



Reach 2

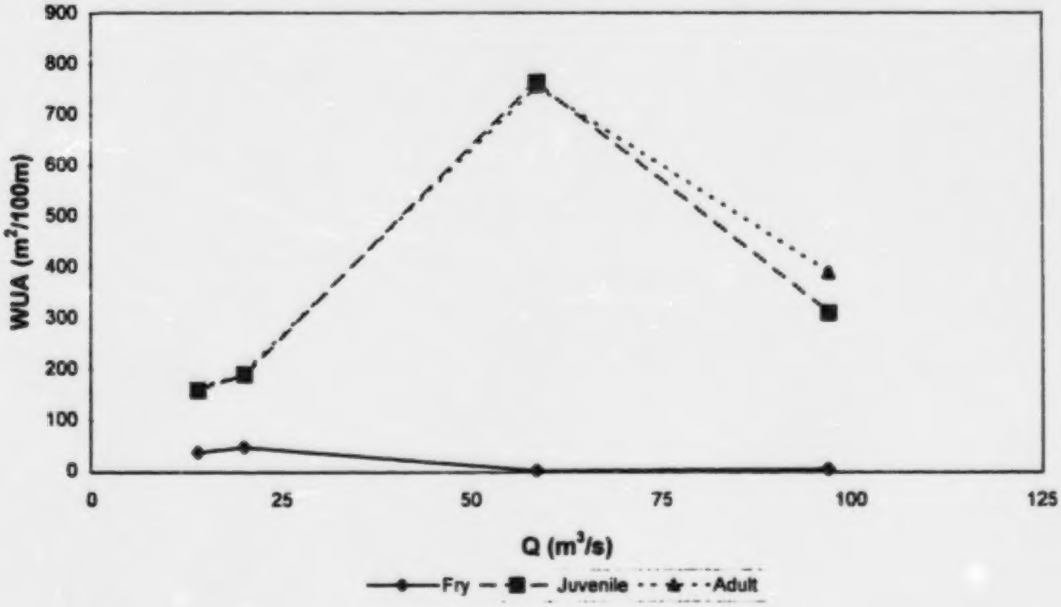


Figure 73 Weighted Usable Area for Goldeye as a Function of Discharge in Reaches 1 and 2 of the Red Deer River.

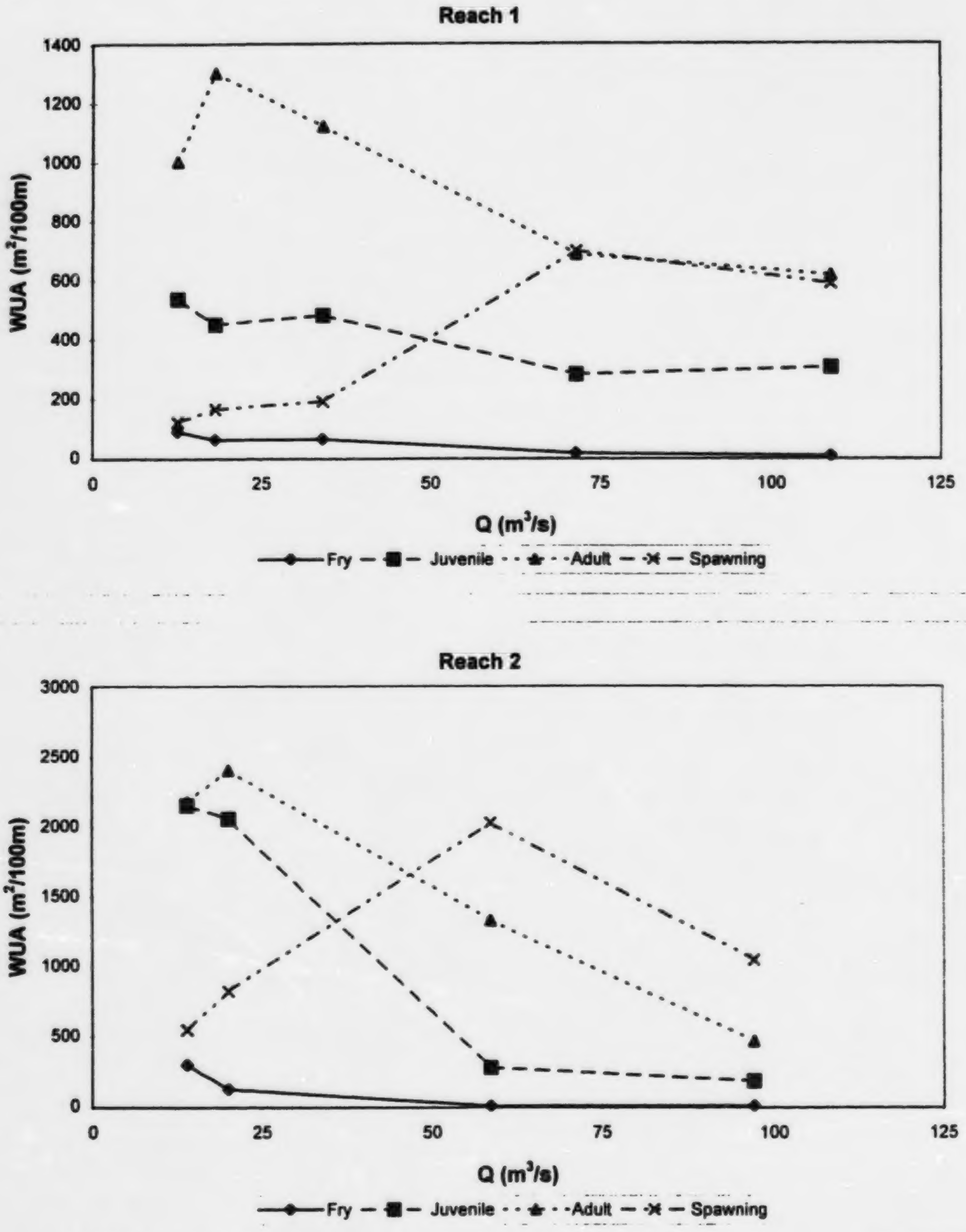
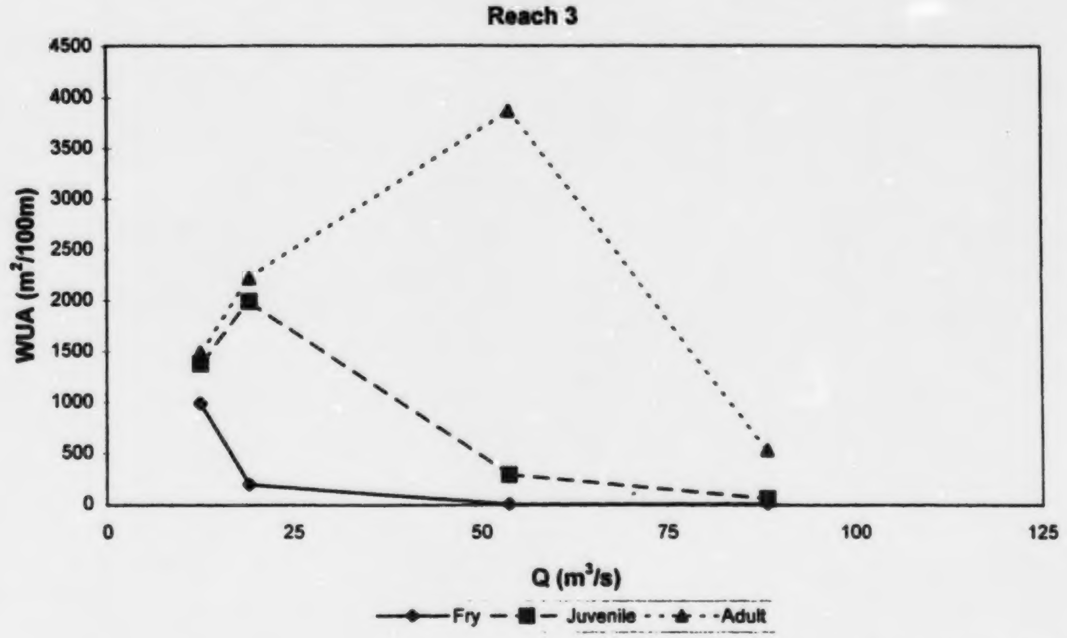


Figure 74 Weighted Usable Area for Walleye as a Function of Discharge in Reaches 1 and 2 of the Red Deer River.



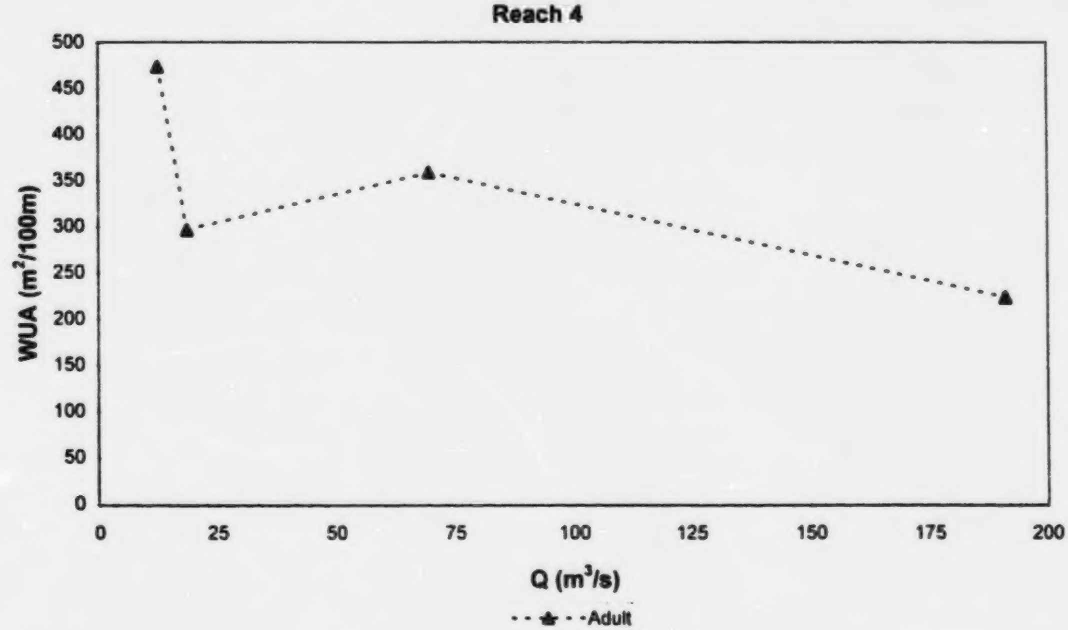
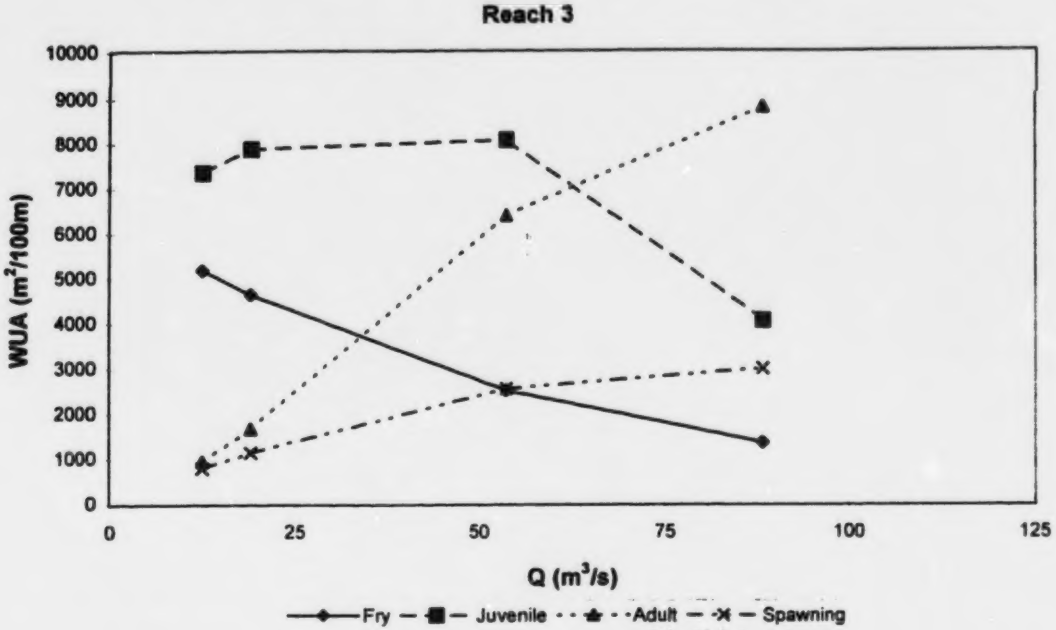


Figure 75 Weighted Usable Area for Walleye as a Function of Discharge in Reaches 3 and 4 of the Red Deer River.



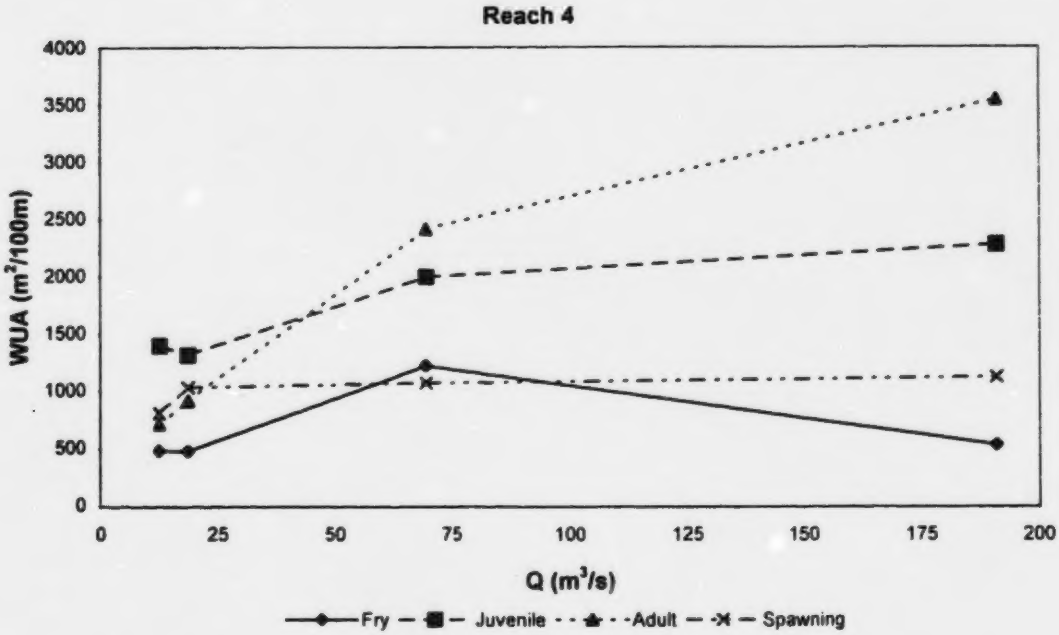


Figure 76 **Weighted Usable Area for Mountain Whitefish as a Function of Discharge in Reaches 3 and 4 of the Red Deer River.**

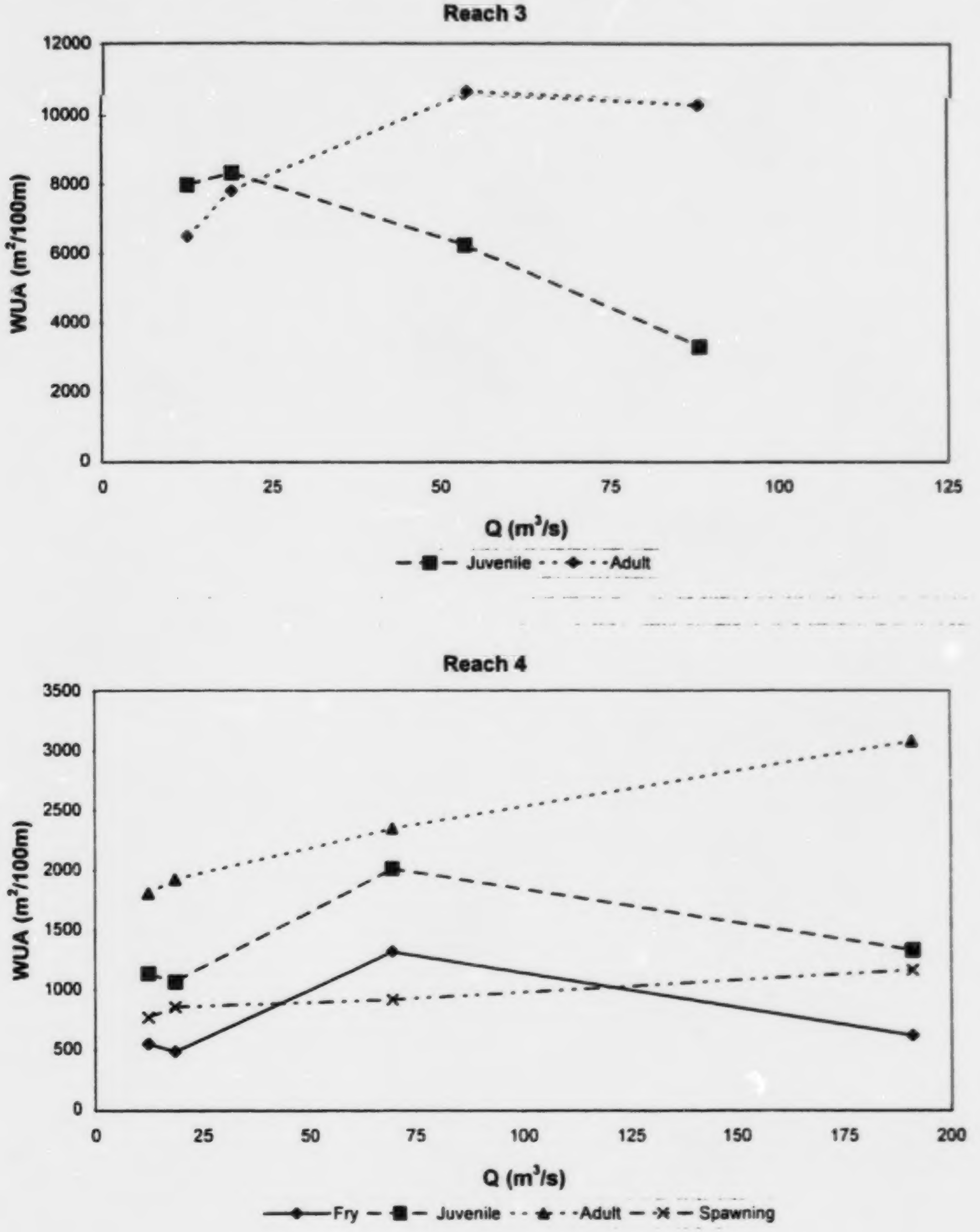


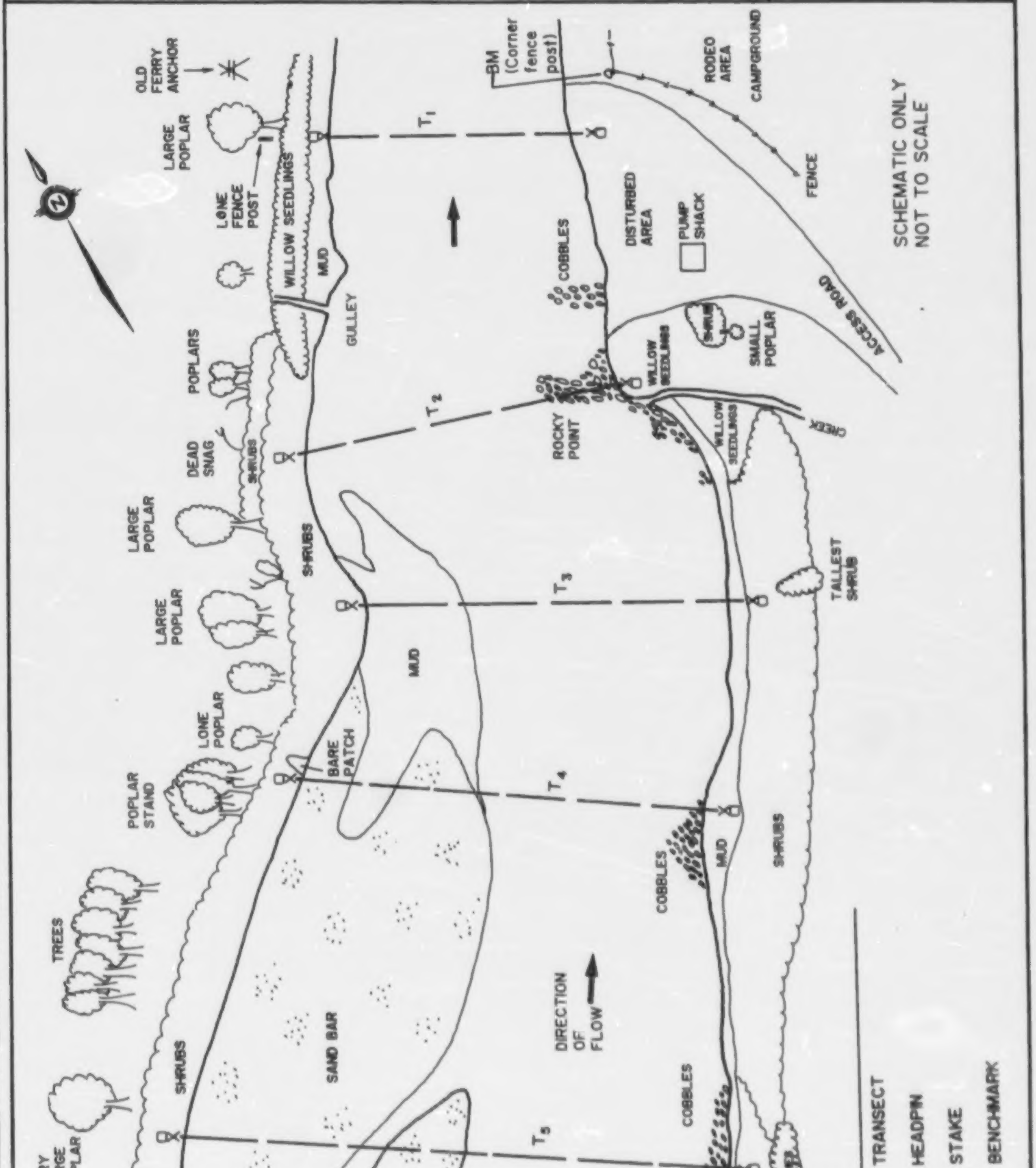
Figure 77 Weighted Usable Area for Brown Trout as a Function of Discharge in Reaches 3 and 4 of the Red Deer River.

APPENDIX I

SCHEMATIC DIAGRAMS OF THE FOUR STUDY REACHES

STUDY REACH DIAGRAM - RED DEER RIVER
SEGMENT 1 - OCTOBER 10,1991

Figure I.1



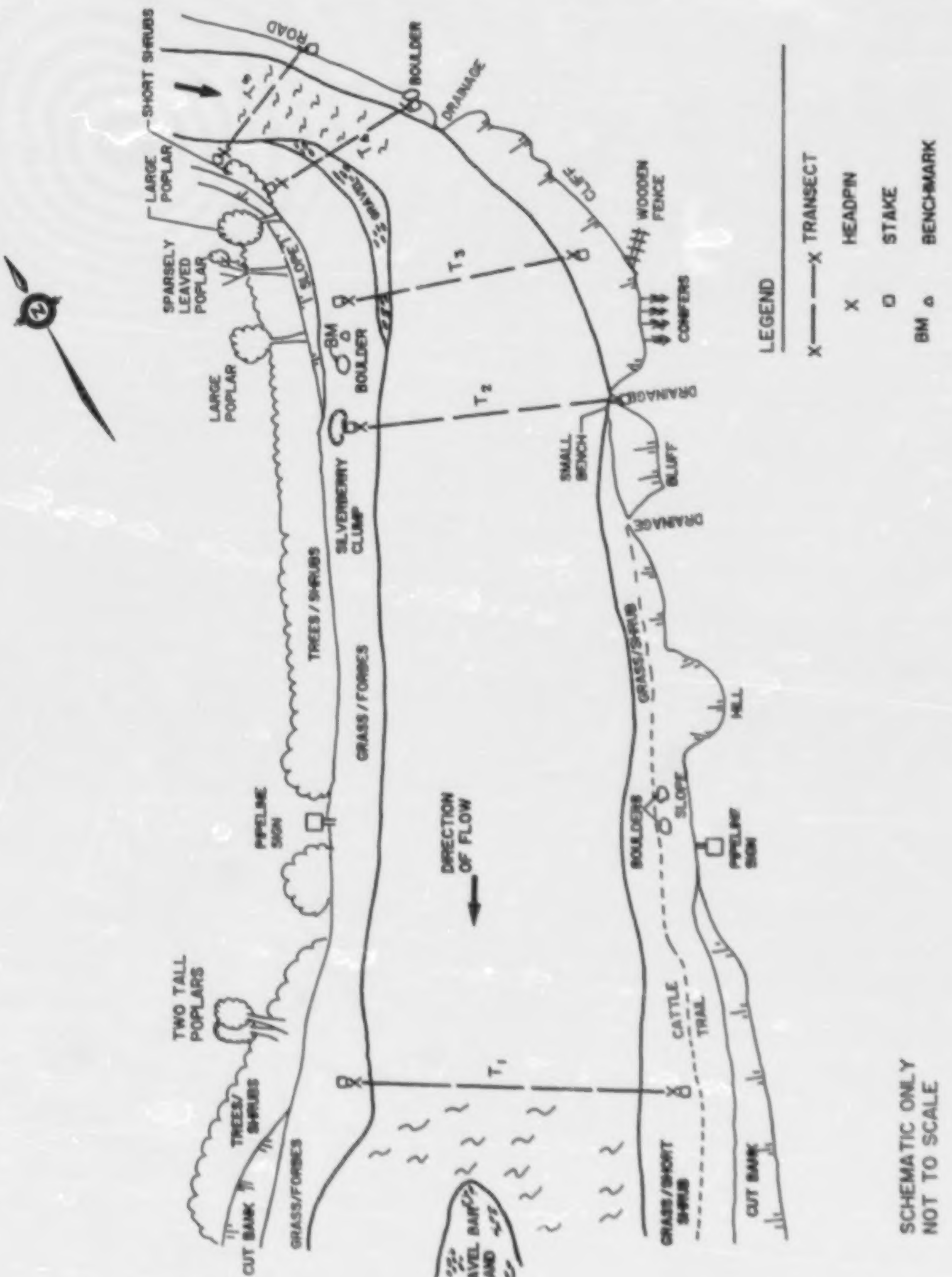
SCHEMATIC ONLY NOT TO SCALE

PROJECT No. 942-2299 DRAWN CG REVIEWED ______ DATE 30 DEC 93

Golder Associates

STUDY REACH DIAGRAM - RED DEER RIVER SEGMENT 2 - OCTOBER 9,1991

Figure I.2



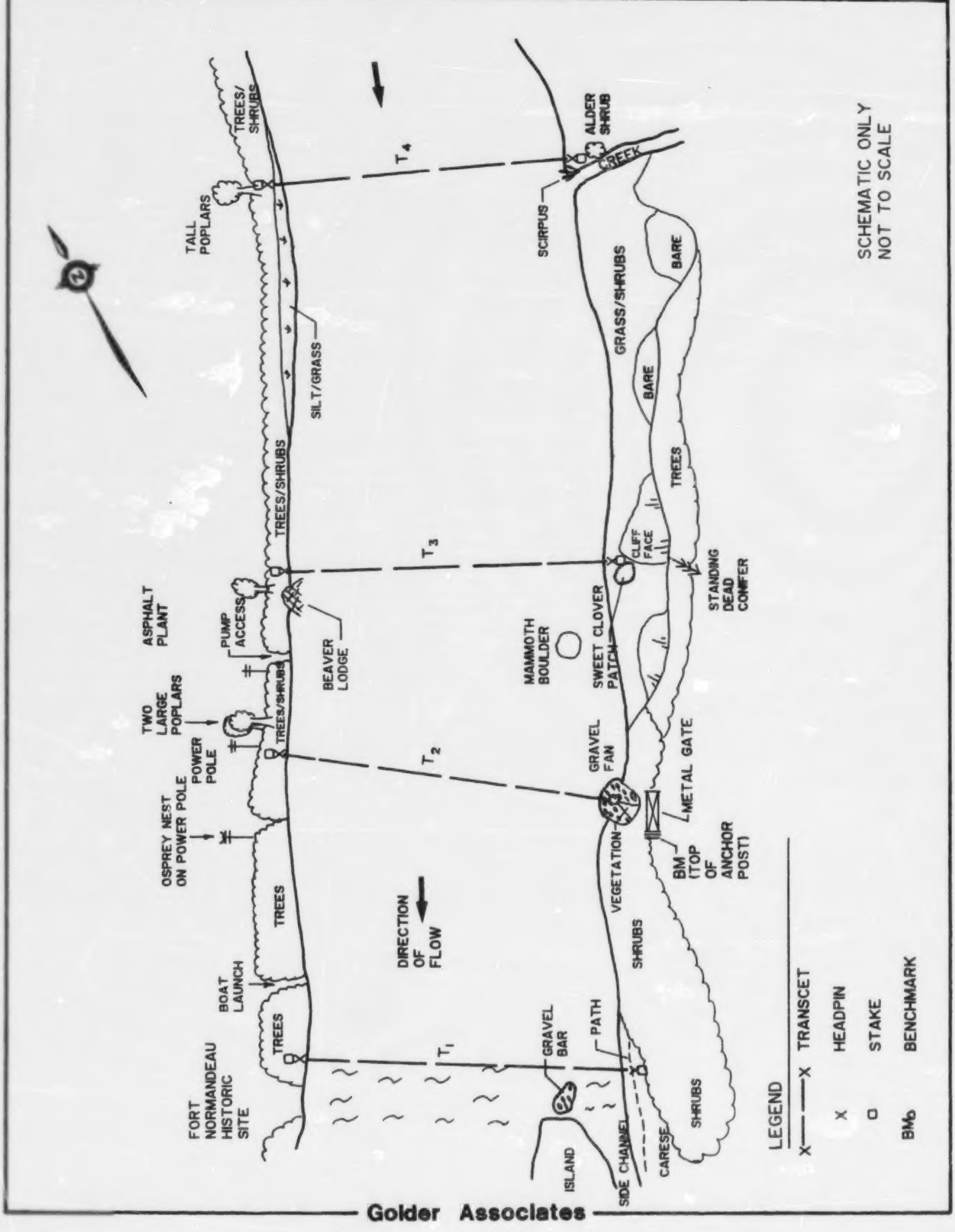
SCHEMATIC ONLY
NOT TO SCALE

PROJECT No. 942-2298 DRAWN CG REVIEWED ______ DATE 30 DEC 93

Golder Associates

STUDY REACH DIAGRAM - RED DEER RIVER
SEGMENT 3 - OCTOBER 8,1991

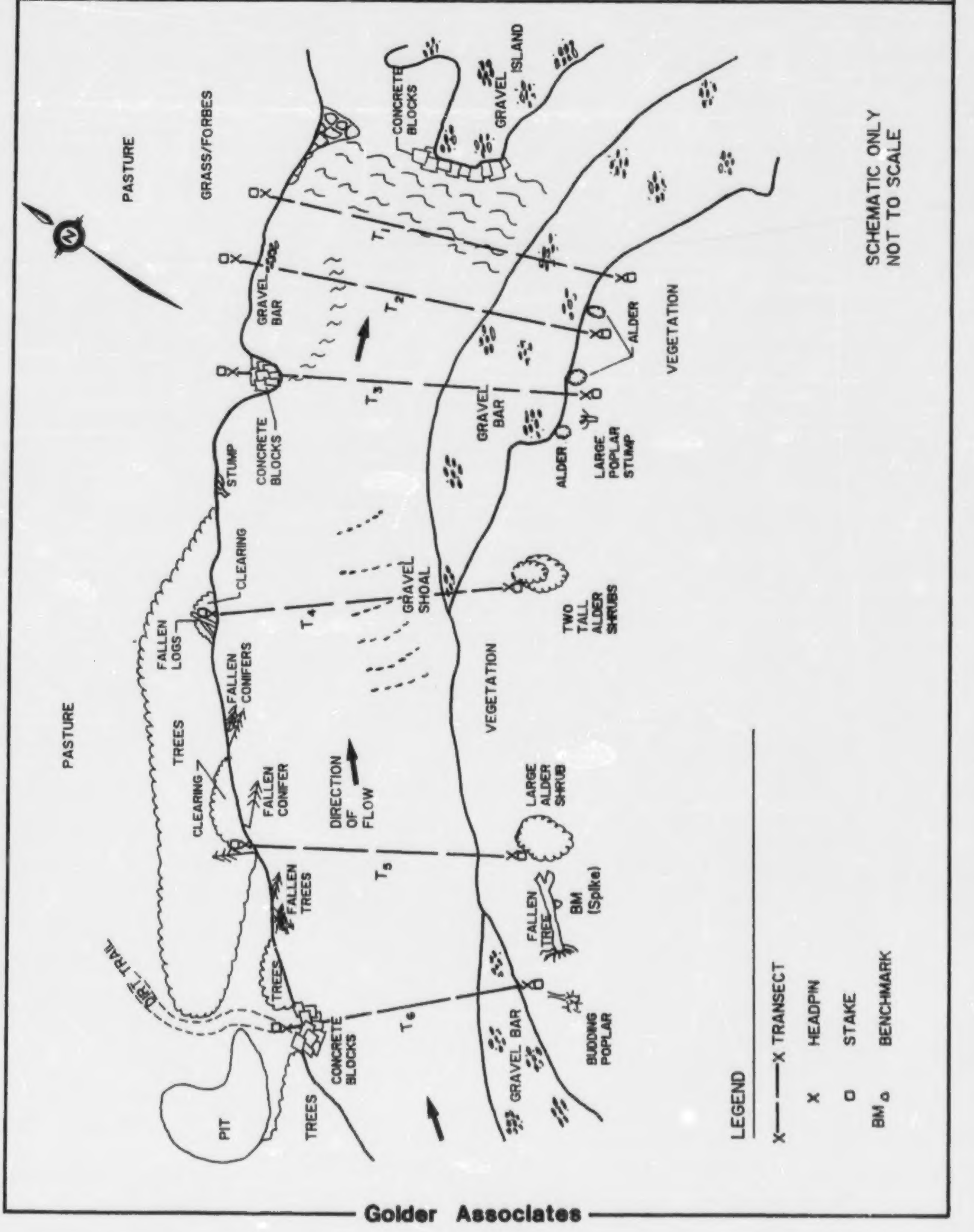
Figure I.3



PROJECT No. 942-2299 DRAWN CG REVIEWED AL DATE 30 DEC 93

STUDY REACH DIAGRAM - RED DEER RIVER
SEGMENT 4 - OCTOBER 7, 1991

Figure I.4



PROJECT No. 942-2299 DRAWN CG REVIEWED MC DATE 29 DEC 93

Golder Associates

APPENDIX II

PHOTOGRAPHS OF THE STUDY REACHES AT THE VARIOUS RIVER STAGES

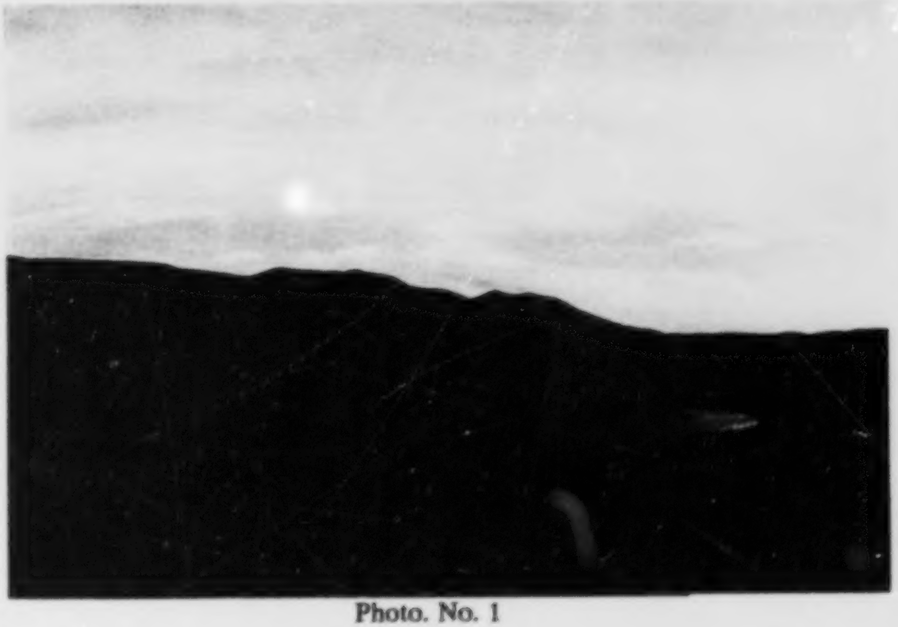


Photo. No. 1

Photo No. 2

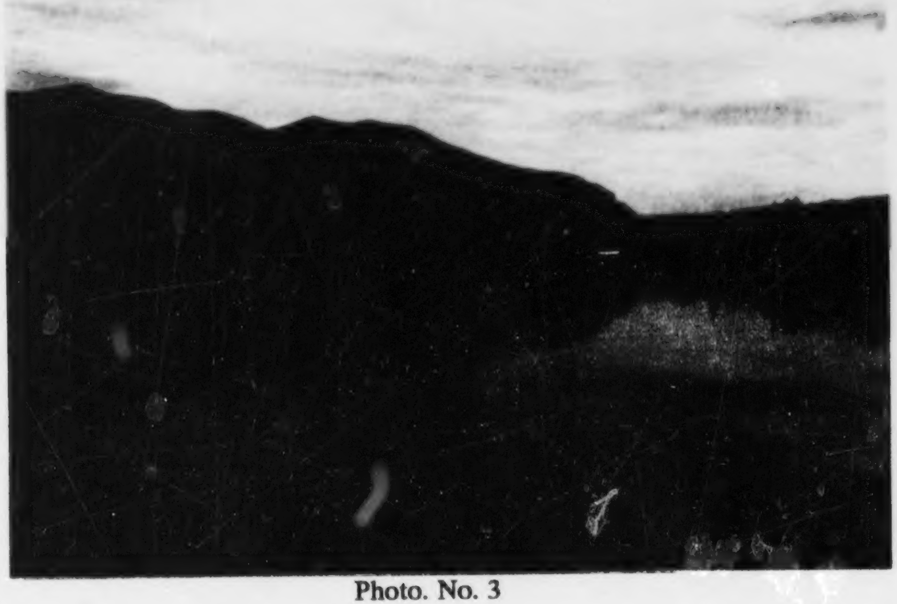


Photo. No. 3

PLATE II.1 - Red Deer River, Reach 1 (Jenner)

Photo. No. 1 - Low stage, from top of reach.

Photo. No. 2 - Low stage, view downstream from transect 4

Photo. No. 3 - Medium stage, view downstream from transect 4

Photo. No. 1

Photo No. 2

Photo. No. 3

PLATE II.2 - Red Deer River, Reach 2 (Big Valley)

Photo. No. 1 - Low stage, view upstream from transect 1

Photo. No. 2 - Medium stage, view upstream from transect 1

Photo. No. 3 - Medium stage, view downstream from transect 2

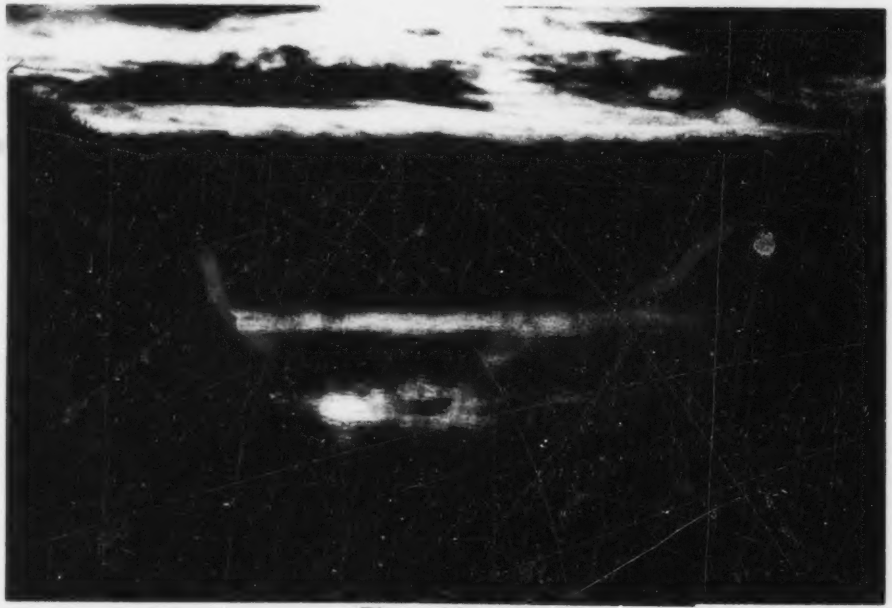


Photo. No. 1

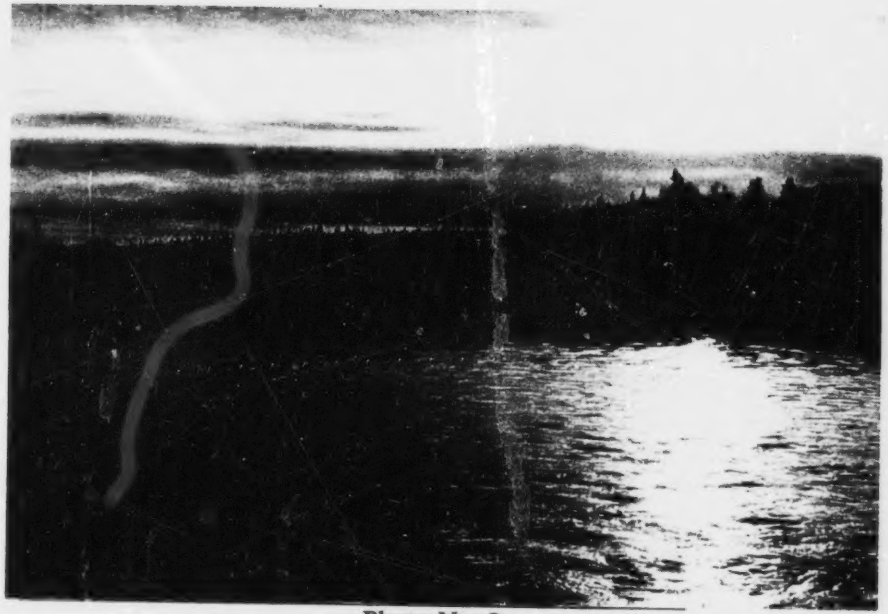


Photo No. 2

PLATE II.3 - Red Deer River, Reach 3 (Red Deer)

Photo. No. 1 - High stage, view downstream from transect 3

Photo. No. 2 - Medium stage, view downstream from transect 4

Photo. No. 1

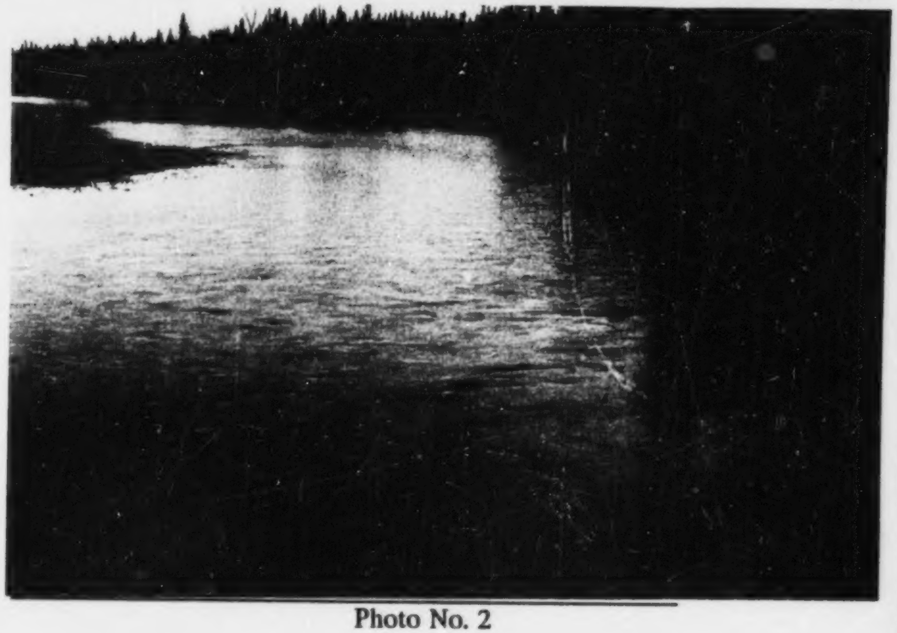


Photo No. 2

Photo. No. 3

PLATE II.4 - Red Deer River, Reach 4 (Dickson)

Photo. No. 1 - Low stage, view from top of reach.

Photo. No. 2 - Low stage, view upstream from transect 3

Photo. No. 3 - Medium stage, view downstream from transect 3

APPENDIX III

TRANSFERABILITY ANALYSIS FOR OFF-SITE CRITERIA TO THE RED DEER RIVER

TABLE III-1

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR BROWN TROUT FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.08	0.00	0.00	8246.51	0.66	0.00	0.00	0.96	6.8	0.63	6.83	24.52
0.16	0.00	0.00	12528.96	1.00	0.00	0.00	1.00	10.8	1.00	17.63	
0.24	0.00	0.00	11890.50	0.95	0.00	0.00	0.67	6.9	0.64	24.52	
0.31	4.7	0.63	5070.91	0.40	1.56	1.00	0.11	0.5	0.04	20.28	Crit. Value
0.39	7.5	1.00	9597.29	0.77	1.31	0.84	0.00	0.00	0.00	12.79	7.00
0.47	3.5	0.46	5591.94	0.45	1.03	0.66	0.00	0.00	0.00	9.33	Result
0.55	3.0	0.40	10344.24	0.83	0.48	0.31	0.00	0.00	0.00	6.34	FAIL
0.63	2.5	0.34	7983.16	0.64	0.53	0.34	0.00	0.00	0.00	3.80	
0.71	2.8	0.37	9699.71	0.77	0.48	0.31	0.00	0.00	0.00	1.04	
0.79	1.0	0.14	8844.97	0.71	0.20	0.13	0.00	0.00	0.00	0.00	

TABLE III-2

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR BROWN TROUT FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	7.00
0.06	1.0	0.10	11808.01	0.18	0.58	0.45	1.00	0.21	0.21	0.32	Crit. Value
0.12	0.00	0.00	29072.58	0.45	0.00	0.00	1.00	0.52	0.52	1.44	8.00
0.19	1.2	0.12	33234.43	0.51	0.23	0.18	1.00	0.60	0.60	2.29	Result
0.25	0.7	0.07	41441.74	0.63	0.11	0.08	1.00	0.75	0.75	4.11	PASS
0.31	6.3	0.64	45164.58	0.69	0.92	0.71	1.00	0.81	0.81	0.51	
0.37	3.5	0.35	46578.61	0.71	0.49	0.38	1.00	0.84	0.84	0.13	
0.44	9.9	1.00	50243.98	0.77	1.30	1.00	1.00	0.91	0.91	7.00	
0.50	2.4	0.24	55452.86	0.85	0.29	0.22	1.00	1.00	1.00	6.07	
0.56	0.00	0.00	58441.23	0.90	0.00	0.00	0.80	0.84	0.84	3.25	

TABLE III-3

HABITAT USE AND AVAILABILITY DATA FOR COVER FOR BROWN TROUT FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
1.00	0.00	0.00	0.04	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.40
2.00	12.5	1.00	0.03	0.78	1.29	0.68	1.00	14.9	1.00	2.40	Crit. Value
3.00	12.5	1.00	0.02	0.52	1.90	1.00	1.00	10.1	0.68	0.00	3.00
											Result
											PASS

TABLE III-4

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR BROWN TROUT JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.78	0.0	0.00	21358.90	0.98	0.00	0.00	1.00	0.98	1.00	10.98	10.98
0.94	8.0	1.00	19257.00	0.88	1.13	0.17	0.90	0.80	0.81	9.11	Crit. Value
1.09	6.0	0.75	11506.70	0.53	1.42	0.21	0.70	0.37	0.38	5.96	8.00
1.25	3.0	0.38	1209.80	0.06	6.75	1.00	0.50	0.03	0.03	3.17	Result
1.40	3.0	0.38	4809.90	0.22	1.70	0.25	0.50	0.11	0.11	1.02	FAIL
1.56	0.0	0.00	2890.70	0.13	0.00	0.00	0.50	0.07	0.07	1.53	
1.72	5.0	0.63	3016.20	0.14	4.51	0.67	0.50	0.07	0.07	2.94	
1.87	0.0	0.00	4194.80	0.19	0.00	0.00	0.50	0.10	0.10	2.20	

TABLE III-5

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR BROWN TROUT JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.18	0.0	0.00	36535.70	1.00	0.00	0.00	0.24	3.4	0.68	3.43	4.23
0.36	4.0	0.44	17248.10	0.47	0.94	0.32	0.49	3.3	0.66	2.75	Crit. Value
0.54	2.0	0.22	11923.30	0.33	0.68	0.23	0.75	3.4	0.69	4.23	7.00
0.72	9.0	1.00	12578.90	0.34	2.90	1.00	1.00	4.9	0.98	0.14	Result
0.90	8.0	0.89	15888.50	0.43	2.04	0.70	0.81	5.0	1.00	2.84	PASS
1.08	1.0	0.11	24960.30	0.68	0.16	0.06	0.48	4.8	0.93	0.84	
1.26	1.0	0.11	14787.30	0.40	0.27	0.09	0.03	0.2	0.03	0.00	
1.44	0.0	0.00	3105.10	0.08	0.00	0.00	0.00	0.0	0.00	0.00	

TABLE III-6

HABITAT USE AND AVAILABILITY DATA FOR COVER FOR BROWN TROUT JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
1.00	1.6	0.09	0.08	1.00	0.09	0.06	0.00	0.00	0.00	1.56	2.27
2.00	17.9	1.00	0.06	0.70	1.43	1.00	1.00	17.3	1.00	2.27	Crit. Value
3.00	5.5	0.30	0.04	0.48	0.64	0.45	1.00	7.7	0.45	0.00	3.00
											Result
											PASS

TABLE III-7

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR BROWN TROUT ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.66	0.0	0.00	20445.86	0.73	0.00	0.00	0.16	0.11	0.15	1.73	16.78
0.88	0.3	0.04	27399.93	0.97	0.05	0.01	0.55	0.53	0.71	6.37	Crit. Value
1.10	1.2	0.19	22652.94	0.80	0.23	0.04	0.94	0.75	1.00	12.15	8.00
1.32	1.2	0.19	17696.84	0.63	0.30	0.05	1.00	0.63	0.84	16.78	Result
1.54	6.4	1.00	6432.90	0.23	4.38	0.74	1.00	0.23	0.30	12.43	FAIL
1.77	6.0	0.93	4394.53	0.16	5.95	1.00	0.80	0.12	0.17	7.57	
1.99	3.6	0.56	4706.67	0.17	3.33	0.56	0.50	0.08	0.11	4.73	
2.21	3.6	0.56	4656.96	0.17	3.37	0.57	0.50	0.08	0.11	1.89	
2.43	3.6	0.56	4171.54	0.15	3.76	0.63	0.50	0.07	0.10	1.03	
2.65	0.00	0.00	719.74	0.03	0.00	0.00	0.50	0.01	0.02	0.91	

TABLE III-8

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR BROWN TROUT ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.15	0.00	0.00	17643.43	0.66	0.00	0.00	0.36	0.23	0.53	2.88	5.00
0.31	1.4	0.18	13086.34	0.49	0.37	0.16	0.57	0.28	0.63	5.00	Crit. Value
0.46	5.6	0.73	8870.74	0.33	2.19	0.97	0.79	0.26	0.59	2.87	7.00
0.61	6.3	0.82	9716.33	0.36	2.26	1.00	1.00	0.36	0.83	1.33	Result
0.76	7.7	1.00	13741.54	0.51	1.95	0.86	0.86	0.44	1.00	0.60	PASS
0.92	5.0	0.66	11127.43	0.42	1.58	0.70	0.59	0.24	0.56	2.41	
1.07	0.00	0.00	20487.08	0.77	0.00	0.00	0.32	0.24	0.55	0.59	

TABLE III-9

HABITAT USE AND AVAILABILITY DATA FOR COVER FOR BROWN TROUT ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
1.00	0.8	0.04	0.08	1.00	0.04	0.00	0.00	0.00	0.00	0.76	2.08
2.00	14.0	1.00	0.01	0.08	11.95	1.00	1.00	17.8	1.00	2.08	Crit. Value
3.00	6.2	0.32	0.00	0.04	8.31	0.69	1.00	8.2	0.46	0.00	3.00
											Result
											PASS

TABLE III-10

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR BROWN TROUT SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.32	0.0	0.00	0.21	0.22	0.00	0.00	1.00	0.22	0.50	6.33	7.63
0.38	2.4	0.29	0.36	0.38	0.75	0.25	0.92	0.35	0.78	7.26	Crit. Value
0.45	3.6	0.43	0.49	0.52	0.83	0.27	0.80	0.41	0.93	7.63	10.00
0.51	8.5	1.00	0.31	0.33	3.03	1.00	0.68	0.23	0.50	1.47	Result
0.58	1.2	0.14	0.32	0.34	0.42	0.14	0.56	0.19	0.43	2.09	PASS
0.64	7.3	0.86	0.95	1.00	0.86	0.28	0.45	0.45	1.00	0.78	
0.71	3.6	0.43	0.69	0.73	0.59	0.19	0.33	0.24	0.54	2.06	
0.77	0.0	0.00	0.64	0.67	0.00	0.00	0.21	0.14	0.32	0.71	
0.83	0.3	0.04	0.70	0.74	0.05	0.02	0.10	0.07	0.17	0.33	
0.90	0.0	0.00	0.33	0.34	0.00	0.00	0.10	0.03	0.08	0.01	
0.96	0.3	0.04	0.61	0.64	0.06	0.02	0.10	0.06	0.14	0.28	
1.03	0.8	0.08	0.25	0.26	0.30	0.10	0.10	0.03	0.06	0.12	
1.09	0.0	0.00	0.01	0.01	0.00	0.00	0.10	0.00	0.00	0.11	

TABLE III-11

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR BROWN TROUT SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.21	0.0	0.00	0.06	0.08	0.00	0.00	0.08	0.1	0.01	0.05	7.05
0.31	0.6	0.05	0.20	0.24	0.22	0.06	0.42	0.8	0.11	0.24	Crit. Value
0.42	0.3	0.03	0.21	0.26	0.10	0.03	0.81	1.7	0.22	1.66	8.00
0.52	0.3	0.03	0.38	0.46	0.06	0.02	1.00	3.7	0.48	5.10	Result
0.63	2.4	0.20	0.43	0.53	0.38	0.10	1.00	4.3	0.55	7.05	PASS
0.73	11.8	1.00	0.21	0.26	3.87	1.00	1.00	2.1	0.27	2.69	
0.84	7.6	0.65	0.81	1.00	0.65	0.17	0.96	7.8	1.00	2.69	
0.94	3.6	0.30	0.39	0.48	0.63	0.16	0.52	2.0	0.26	4.14	
1.05	0.0	0.00	0.62	0.76	0.00	0.00	0.50	3.2	0.40	1.05	
1.15	1.4	0.10	0.35	0.43	0.23	0.06	0.50	1.7	0.22	0.49	
1.26	0.00	0.00	0.23	0.29	0.00	0.00	0.21	0.6	0.06	0.00	

TABLE III-12

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR BROWN TROUT SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Wt. Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
3.46	0.0	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	15.36
3.63	4.7	0.72	3.14	0.41	1.75	0.81	0.09	0.04	0.04	4.53	Crit. Value
3.79	1.2	0.18	5.52	0.72	0.25	0.11	0.32	0.23	0.23	4.36	8.00
3.96	6.2	0.95	5.53	0.72	1.31	0.60	0.60	0.44	0.44	8.08	Result
4.12	5.9	0.90	3.17	0.42	2.17	1.00	0.88	0.37	0.37	11.88	FAIL
4.29	6.6	1.00	4.08	0.54	1.87	0.86	1.00	0.54	0.54	15.36	
4.45	1.2	0.18	2.66	0.35	0.52	0.24	1.00	0.35	0.35	14.53	
4.62	1.2	0.18	6.47	0.85	0.21	0.10	1.00	0.85	0.85	10.81	
4.78	0.3	0.05	3.16	0.41	0.12	0.05	1.00	0.41	0.41	8.73	
4.95	0.7	0.10	7.62	1.00	0.10	0.05	1.00	1.00	1.00	3.60	
5.11	0.0	0.00	3.23	0.42	0.00	0.00	0.78	0.33	0.33	1.69	

TABLE III-13

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.69	0.0	0.00	2100.00	1.00	0.00	0.00	0.78	0.78	10.98	12.58	14.22
0.81	7.0	1.00	11447.10	0.54	1.84	1.00	1.00	0.54	7.62	13.20	Crit. Value
0.92	5.0	0.71	13137.60	0.62	1.15	0.62	0.69	0.43	6.02	14.22	7.00
1.04	6.0	0.86	12656.90	0.60	1.43	0.78	0.15	0.09	1.27	9.49	Result
1.15	7.0	1.00	20636.80	0.98	1.02	0.55	0.04	0.04	0.51	3.00	FAIL
1.27	2.0	0.29	8828.20	0.42	0.68	0.37	0.00	0.00	0.00	1.00	
1.38	0.0	0.00	8346.90	0.40	0.00	0.00	0.00	0.00	0.00	1.00	
1.50	1.0	0.14	6423.20	0.30	0.47	0.25	0.00	0.00	0.00	0.00	
1.62	0.0	0.00	2154.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	

TABLE III-14

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.76	0.0	0.00	0.00	5.90
0.15	3.0	0.25	13974.70	0.27	0.93	0.22	1.00	8.9	1.00	5.90	Crit. value
0.31	8.0	0.67	8819.50	0.17	3.93	0.92	0.91	4.9	0.57	3.02	7.00
0.46	12.0	1.00	12131.70	0.23	4.28	1.00	0.81	6.3	0.71	2.70	Result
0.62	4.0	0.33	16718.20	0.32	1.04	0.24	0.52	5.6	0.62	1.15	PASS
0.77	0.0	0.00	3416.10	0.07	0.00	0.00	0.25	0.7	0.06	0.60	
0.93	0.0	0.00	25047.50	0.48	0.00	0.00	0.08	1.3	0.15	0.74	
1.08	1.0	0.08	4505.20	0.09	0.96	0.22	0.03	0.0	0.01	0.17	
1.24	0.0	0.00	23878.40	0.46	0.00	0.00	0.01	0.3	0.02	0.00	

TABLE III-15

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH FRY, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
2.71	0.0	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.01	16.58
3.10	6.0	1.00	3007.40	0.04	24.27	0.80	0.29	0.01	0.01	5.82	Crit. value
3.49	4.0	0.67	0.00	0.00	0.00	0.00	0.51	0.00	0.00	9.82	8.00
3.87	5.0	0.83	2007.40	0.03	30.29	1.00	0.75	0.02	0.02	14.54	Result
4.27	6.0	1.00	22612.30	0.31	3.23	0.11	0.94	0.29	0.32	16.58	FAIL
4.65	3.0	0.50	28839.10	0.40	1.27	0.04	1.00	0.40	0.44	14.19	
5.04	3.0	0.50	72975.40	1.00	0.50	0.02	0.90	0.90	1.00	4.90	
5.42	1.0	0.17	24648.60	0.34	0.49	0.02	0.72	0.24	0.27	2.59	
5.81	0.0	0.00	20320.50	0.28	0.00	0.00	0.53	0.15	0.16	0.59	

TABLE III-16

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.91	0.0	0.00	11668.00	0.58	0.00	0.00	0.93	0.55	0.72	19.76	20.56
0.99	1.0	0.13	7177.50	0.36	0.35	0.12	0.83	0.30	0.39	20.56	Crit. value
1.07	2.0	0.25	6530.00	0.33	0.77	0.26	0.69	0.22	0.30	19.93	9.00
1.16	6.0	0.75	20006.20	1.00	0.75	0.25	0.54	0.54	0.72	17.23	Result
1.24	2.0	0.25	6083.50	0.30	0.82	0.27	0.40	0.12	0.16	15.97	FAIL
1.32	8.0	1.00	6686.10	0.33	2.99	1.00	0.25	0.08	0.11	8.48	
1.41	5.0	0.63	5037.10	0.25	2.48	0.83	0.18	0.05	0.06	3.76	
1.49	4.0	0.50	5791.60	0.29	1.73	0.53	0.11	0.03	0.04	0.05	
1.57	0.0	0.00	631.60	0.03	0.00	0.00	0.06	0.00	0.00	0.03	

TABLE III-17

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.72	0.0	0.00	0.00	13.55
0.13	1.0	0.14	13956.40	0.34	0.42	0.04	0.94	10.1	1.00	8.87	Crit. value
0.26	3.0	0.43	3501.30	0.08	5.04	0.43	1.00	2.5	0.27	8.50	8.00
0.39	4.0	0.57	13830.50	0.34	1.70	0.15	0.87	9.1	0.92	13.55	Result
0.52	7.0	1.00	14536.80	0.35	2.83	0.24	0.33	3.8	0.37	10.16	FAIL
0.65	6.0	0.86	6699.70	0.16	5.27	0.45	0.27	1.3	0.14	5.55	
0.77	5.0	0.71	2535.50	0.06	11.61	1.00	0.21	0.3	0.04	0.95	
0.90	2.0	0.29	5231.80	0.13	2.25	0.19	0.09	0.3	0.04	0.68	
1.03	0.0	0.00	23469.10	0.57	0.00	0.00	0.03	0.6	0.06	0.09	

TABLE III-18

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
3.60	0.0	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	1.83	4.05
3.93	2.0	0.22	10129.00	0.13	1.66	0.32	0.81	0.11	0.19	2.06	Crit. value
4.25	9.0	1.00	14490.70	0.19	5.23	1.00	0.74	0.14	0.25	4.05	9.00
4.58	3.0	0.33	18375.70	0.24	1.37	0.26	0.65	0.16	0.28	3.82	Result
4.91	5.0	0.56	75777.90	1.00	0.56	0.11	0.56	0.56	1.00	2.63	PASS
5.23	5.0	0.56	16846.40	0.22	2.50	0.48	0.47	0.10	0.19	0.23	
5.56	3.0	0.33	20487.90	0.27	1.23	0.24	0.38	0.10	0.19	1.10	
5.89	1.0	0.11	15296.60	0.20	0.55	0.11	0.31	0.06	0.11	0.81	
6.22	0.0	0.00	7698.80	0.10	0.00	0.00	0.25	0.03	0.05	0.29	

TABLE III-19

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
1.08	0.0	0.00	13288.50	0.47	0.00	0.00	0.88	0.42	0.46	14.98	17.73
1.24	5.0	0.25	26089.70	0.93	0.27	0.11	0.97	0.91	1.00	17.73	Crit. value
1.39	20.0	1.00	11091.60	0.40	2.53	1.00	1.00	0.40	0.44	1.11	8.00
1.55	5.0	0.25	6423.20	0.23	1.09	0.43	0.97	0.22	0.24	2.00	Result
1.70	1.0	0.05	3005.90	0.11	0.47	0.18	0.86	0.09	0.1	2.21	FAIL
1.85	0.0	0.00	3980.50	0.14	0.00	0.00	0.71	0.10	0.11	1.35	

TABLE III-20

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
.21	0.0	0.00	9464.40	0.43	0.00	0.00	0.58	0.25	0.44	3.96	6.84
.31	3.0	0.23	7968.80	0.36	0.63	0.30	0.76	0.28	0.48	4.10	Crit. value
.42	13.0	1.00	10388.30	0.47	2.11	1.00	0.91	0.43	0.75	4.00	8.00
.52	7.0	0.54	12642.50	0.58	0.93	0.44	1.00	0.58	1.00	4.46	Result
.63	3.0	0.23	5819/10	0.27	0.87	0.41	1.00	0.27	0.46	4.44	PASS
.73	0.0	0.00	2157.40	0.10	0.00	0.00	0.90	0.09	0.15	3.44	
.84	5.0	0.38	4429.60	0.20	1.90	0.90	0.70	0.14	0.24	6.84	
.94	0.0	0.00	21876.60	1.00	0.00	0.00	0.50	0.50	0.86	1.23	

TABLE III-21

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
2.96	0.0	0.00	818.30	0.02	0.00	0.00	0.10	0.00	0.01	0.05	4.74
3.33	4.0	0.44	2189.10	0.05	9.66	1.00	0.16	0.01	0.02	3.74	Crit. value
3.69	1.0	0.11	0.00	0.00	0.00	00	0.24	0.00	0.00	4.74	8.00
4.06	1.0	0.11	20056.30	0.42	0.26	0.03	0.31	0.13	0.41	1.96	Result
4.43	6.0	0.67	22042.40	0.46	1.44	0.15	0.34	0.16	0.50	3.40	PASS
4.80	5.0	0.56	47557.80	1.00	0.56	0.06	0.32	0.32	1.00	0.80	
5.17	9.0	1.00	38302.90	0.81	1.24	0.13	0.27	0.22	0.67	2.00	
5.54	5.0	0.56	28147.30	0.59	0.94	0.10	0.23	0.14	0.43	3.08	
5.91	0.0	0.00	17000.20	0.36	0.00	0.00	0.19	0.07	0.21	1.15	

TABLE III-22

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.36	0.0	0.00	5860.7	0.24	0.00	0.00	0.00	0.00	0.00	0.0	2.93
0.48	1.0	0.08	12642.5	0.51	0.15	0.17	0.49	0.25	0.30	2.11	Crit. value
0.60	13.0	1.00	21166.7	0.85	1.18	0.91	0.98	0.84	1.00	0.37	7.00
0.72	10.0	0.77	14753.1	0.59	1.30	1.00	1.00	0.59	0.71	2.93	Result
0.84	2.0	0.15	7736.1	0.31	0.50	0.38	0.67	0.21	0.25	2.31	PASS
0.95	0.0	0.00	13890.3	0.55	0.00	0.00	0.33	0.18	0.22	0.0	

TABLE III-23

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.43	0.0	0.00	18357.1	0.41	0.00	0.00	0.00	0.00	0.00	0.00	4.73
0.64	2.0	0.17	19342.2	0.43	0.39	0.05	0.47	0.20	0.35	3.70	Crit. value
0.85	12.0	1.00	5706.4	0.13	7.93	1.00	1.00	0.13	0.22	4.73	7.00
1.07	11.0	0.92	26381.8	0.58	1.57	0.20	1.00	0.58	1.00	0.73	Result
1.28	1.0	0.83	45232.2	1.00	0.08	0.01	0.01	0.01	0.02	0.0	PASS
1.49	0.0	0.00	39745.7	0.88	0.00	0.00	0.00	0.00	0.00	0.0	

TABLE III-24

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH SPAWNING, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
3.86	0.0	0.00	1914.9	0.03	0.00	0.00	0.00	0.00	0.00	0.00	6.27
4.25	1.0	0.10	9727.1	0.13	0.27	0.27	0.33	0.04	0.04	0.43	Crit. value
4.63	3.0	0.30	25096.2	0.34	0.31	0.32	0.66	0.23	0.23	0.50	7.00
5.02	6.0	0.60	72780.1	1.00	0.21	0.22	1.00	1.00	1.00	6.27	Result
5.40	10.0	1.00	26561.7	0.36	1.00	1.00	1.00	0.36	0.37	0.94	PASS
5.79	4.0	0.40	20089.8	0.27	0.53	0.53	1.00	0.28	0.28	0.47	
6.17	1.0	0.10	10643.5	0.15	0.25	0.25	0.67	0.10	0.10	0.72	
6.56	1.0	0.10	0.4662.1	0.06	0.57	0.57	0.34	0.02	0.02	0.00	
6.95	0.0	0.00	435.9	0.01	0.00	0.00	0.00	0.00	0.00	0.00	

TABLE III-25

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR WALLEYE JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.85	0.0	0.00	34025.19	1.00	0.00	0.00	0.49	7.3	0.65	7.19	18.97
1.13	2.5	0.26	25543.15	0.75	0.35	0.02	1.00	11.1	1.00	15.80	Crit. value
1.41	0.0	0.00	7301.42	0.21	0.00	0.00	1.00	3.1	0.29	18.97	8.00
1.70	5.1	0.55	5780.05	0.17	3.22	0.14	0.70	1.8	0.16	15.60	Result
1.98	7.3	0.78	6280.19	0.18	4.24	0.19	0.50	1.3	0.12	9.61	FAIL
2.26	9.4	1.00	1493.29	0.04	22.79	1.00	0.50	0.3	0.03	0.56	
2.55	2.7	0.28	1205.94	0.04	7.99	0.35	0.50	0.3	0.02	1.84	
2.83	0.0	0.00	3449.52	0.10	0.00	0.00	0.50	0.7	0.07	1.09	

TABLE III-26

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR WALLEYE JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.00	1.2	0.12	2.49	0.00	922.26	1.00	0.59	0.0	0.00	1.24	8.93
0.15	3.7	0.37	35241.75	1.00	0.37	0.00	0.59	13.8	1.00	8.93	Crit. value
0.29	10.0	1.00	14928.38	0.42	2.37	0.00	1.00	9.8	0.71	8.84	7.00
0.44	4.4	0.44	10910.83	0.37	1.18	0.00	0.36	3.4	0.23	7.61	Result
0.58	3.9	0.39	10783.82	0.32	1.22	0.00	0.00	0.0	0.00	3.72	FAIL
0.73	3.8	0.37	9393.92	0.23	1.64	0.00	0.00	0.0	0.00	0.00	
0.87	0.0	0.00	10846.31	0.27	0.00	0.00	0.00	0.0	0.00	0.00	

TABLE III-27

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR WALLEYE JUVENILE, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
1.62	0.0	0.00	1520.37	0.03	0.00	0.00	1.00	0.3	0.03	0.27	1.85
2.43	1.2	0.13	680.50	0.01	11.53	1.00	1.00	0.1	0.01	0.85	Crit. value
3.24	0.0	0.00	3002.32	0.05	0.00	0.00	1.00	0.5	0.05	0.31	7.00
4.06	1.2	0.13	11002.69	0.19	0.71	0.06	1.00	1.9	0.19	0.42	Result
4.87	9.2	0.98	59428.51	1.00	0.98	0.09	1.00	10.6	1.00	1.85	PASS
5.68	9.4	1.00	48056.51	0.81	1.24	0.11	1.00	8.6	0.81	1.06	
6.49	6.0	0.63	22132.39	0.37	1.70	0.15	1.00	4.0	0.37	0.91	
7.30	0.0	0.00	4089.90	0.07	0.00	0.00	1.00	0.7	0.07	0.18	

TABLE III-28

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR WALLEYE ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.46	0.0	0.00	20889.95	0.62	0.00	0.00	0.00	0.0	0.00	0.00	14.16
0.69	1.0	0.16	19080.92	0.57	0.29	0.00	0.21	1.6	0.22	0.64	Crit. value
0.91	1.0	0.16	33480.78	1.00	0.16	0.00	0.55	7.3	1.00	6.98	7.00
1.14	0.0	0.00	14809.11	0.44	0.00	0.00	0.89	5.1	0.71	12.20	Result
1.37	0.0	0.00	4910.15	0.15	0.00	0.00	1.00	2.0	0.27	14.15	FAIL
1.60	2.2	0.35	5275.41	0.16	2.19	0.02	1.00	2.1	0.29	14.16	
1.83	6.0	1.00	4957.46	0.15	6.75	0.07	1.00	2.0	0.27	10.07	
2.06	2.0	0.33	4448.55	0.13	2.46	0.03	1.00	1.7	0.24	9.86	
2.29	6.0	1.00	366.94	0.01	91.24	1.00	0.95	0.1	0.02	3.94	
2.52	4.6	0.76	798.36	0.02	32.02	0.35	0.61	0.1	0.03	0.49	
2.74	1.2	0.20	3175.90	0.09	2.11	0.02	0.50	0.7	0.09	1.07	
2.97	0.0	0.00	2581.26	0.08	0.00	0.00	0.50	0.5	0.07	0.56	

TABLE III-29

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR WALLEYE ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

ABBREVIATED PREFERENCE ANALYSIS							CONVERGENCE ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Avail. Freq.	Norm. Avail	Habitat Pref.	Norm. Pref.	Norm. Suit.	Pred. Use	Norm. Pred. Use	Kolmogorov-Smirnov Test	
										|d| Cumulative Act. - Cumulative Pred. Use	Max |d|
0.00	1.7	0.21	1.39	0.00	2614.12	1.00	1.00	0.0	0.00	1.34	9.87
0.06	0.0	0.00	17000.19	1.00	0.00	0.00	1.00	8.0	1.00	4.86	Crit. value
0.12	0.9	0.11	15572.11	0.92	0.12	0.00	1.00	7.3	0.92	9.87	8.00
0.00	4.2	0.52	8285.12	0.49	1.07	0.00	1.00	3.9	0.49	9.62	Result
0.00	7.2	0.89	6050.83	0.36	2.51	0.00	1.00	2.9	0.36	6.26	FAIL
0.31	8.1	1.00	2939.49	0.17	5.78	0.00	1.00	1.3	0.17	1.09	
0.37	2.1	0.26	4222.75	0.25	1.05	0.00	1.00	2.0	0.25	0.99	
0.43	5.0	0.63	4678.43	0.28	2.29	0.00	1.00	2.3	0.28	1.24	
0.49	0.0	0.00	5422.45	0.32	0.00	0.00	1.00	2.5	0.32	0.74	
0.56	0.9	0.11	3440.44	0.20	0.53	0.00	0.48	0.8	0.10	0.67	
0.62	0.9	0.11	4140.29	0.24	0.44	0.00	0.00	0.0	0.00	0.00	
0.68	0.0	0.00	4678.03	0.28	0.00	0.00	0.00	0.0	0.00	0.00	

TABLE III-30

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR WALLEYE ADULT, WITH ABBREVIATED PREFERENCE ANALYSIS AND CONVERGENCE ANALYSIS, RED DEER RIVER

<table>
<tr><th colspan="7">ABBREVIATED PREFERENCE ANALYSIS</th><th colspan="5">CONVERGENCE ANALYSIS</th></tr>
<tr><th rowspan="2">Bin (code)</th><th rowspan="2">Use Freq.</th><th rowspan="2">Norm. Use</th><th rowspan="2">Avail. Freq.</th><th rowspan="2">Norm. Avail</th><th rowspan="2">Habitat Pref.</th><th rowspan="2">Norm. Pref.</th><th rowspan="2">Norm. Suit.</th><th rowspan="2">Pred. Use</th><th rowspan="2">Norm. Pred. Use</th><th colspan="2">Kolmogorov-Smirnov Test</th></tr>
<tr><th>|d| Cumulative Act. - Cumulative Pred. Use</th><th>Max |d|</th></tr>
<tr><td>1.26</td><td>0.0</td><td>0.00</td><td>784.10</td><td>0.02</td><td>0.00</td><td>0.00</td><td>0.37</td><td>0.1</td><td>0.02</td><td>0.09</td><td>3.53</td></tr>
<tr><td>1.57</td><td>1.0</td><td>0.15</td><td>678.36</td><td>0.02</td><td>7.16</td><td>1.00</td><td>0.46</td><td>0.1</td><td>0.02</td><td>0.80</td><td>Crit. value</td></tr>
<tr><td>1.88</td><td>1.0</td><td>0.15</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.0</td><td>0.00</td><td>1.79</td><td>9.00</td></tr>
<tr><td>2.20</td><td>0.0</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.0</td><td>0.00</td><td>1.79</td><td>Result</td></tr>
<tr><td>2.51</td><td>0.0</td><td>0.00</td><td>680.50</td><td>0.02</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.1</td><td>0.02</td><td>1.69</td><td>PASS</td></tr>
<tr><td>2.83</td><td>0.0</td><td>0.00</td><td>810.68</td><td>0.02</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.1</td><td>0.02</td><td>1.56</td><td></td></tr>
<tr><td>3.14</td><td>0.0</td><td>0.00</td><td>2198.10</td><td>0.07</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.3</td><td>0.07</td><td>1.22</td><td></td></tr>
<tr><td>3.45</td><td>0.0</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.00</td><td>0.05</td><td>0.0</td><td>0.00</td><td>1.22</td><td></td></tr>
<tr><td>3.77</td><td>0.0</td><td>0.00</td><td>1249.10</td><td>0.04</td><td>0.00</td><td>0.00</td><td>0.50</td><td>0.2</td><td>0.04</td><td>1.03</td><td></td></tr>
<tr><td>4.08</td><td>1.0</td><td>0.15</td><td>9257.67</td><td>0.28</td><td>0.52</td><td>0.07</td><td>0.50</td><td>1.4</td><td>0.28</td><td>0.59</td><td></td></tr>
<tr><td>4.40</td><td>1.0</td><td>0.15</td><td>10111.96</td><td>0.30</td><td>0.48</td><td>0.07</td><td>0.50</td><td>1.6</td><td>0.30</td><td>0.01</td><td></td></tr>
<tr><td>4.71</td><td>1.7</td><td>0.24</td><td>33458.85</td><td>1.00</td><td>0.24</td><td>0.03</td><td>0.50</td><td>5.2</td><td>1.00</td><td>3.53</td><td></td></tr>
<tr><td>5.02</td><td>5.1</td><td>0.74</td><td>30525.96</td><td>0.91</td><td>0.81</td><td>0.11</td><td>0.50</td><td>4.8</td><td>0.91</td><td>3.20</td><td></td></tr>
</table>

TABLE IV-1

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH ADULT WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.66	0	0.00	0.88	0.00	0.00	0.00	0.17	0.00	0	0	< chance
0.88	7	0.14	1.00	0.14	0.03	0.03	0.19	0.04	-0.0011	0.0839	< chance
1.10	45	0.90	0.41	2.22	0.41	0.41	0.08	0.27	0.1720	0.3605	< chance
1.32	27	0.54	0.22	2.43	0.45	1.00	0.04	0.16	0.0816	0.2379	> chance
1.54	50	1.00	0.18	5.44	1.00	1.00	0.04	0.30	0.198534	0.3932	> chance
1.76	25	0.50	0.16	3.18	0.59	0.59	0.03	0.15	0.072226	0.2236	> chance
1.98	11	0.22	0.14	1.59	0.29	0.29	0.03	0.07	0.012488	0.1177	NS
2.20	2	0.04	0.02	1.83	0.34	0.23	0.00	0.01	-0.00112	0.0349	NS
2.42	1	0.02	0.02	0.93	0.17	0.17	0.00	0.01	-0.01044	0.0223	NS
2.64	0	0.00	0.11	0.00	0.00	0.12	0.02	0.00	0	0	< chance
2.86	1	0.02	0.06	0.35	0.06	0.06	0.01	0.01	-0.01044	0.0223	NS
3.08	0	0.00	0.13	0.00	0.00	0.00	0.03	0.00	0	0	< chance

TABLE IV-2

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH ADULT, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.42	0	0.00	0.40	0.00	0.00	0.00	0.09	0.00	0	0	< chance
0.56	16	0.21	0.35	0.60	0.12	0.12	0.08	0.09	0.0330	0.1563	NS
0.70	15	0.19	0.41	0.48	0.10	0.20	0.09	0.09	0.0289	0.1486	NS
0.84	37	0.48	0.35	1.38	0.27	0.27	0.08	0.22	0.1319	0.3060	> chance
0.98	77	1.00	0.68	1.47	0.29	1.00	0.15	0.46	0.3508	0.5605	> chance
1.12	14	0.18	0.52	0.35	0.07	1.00	0.12	0.08	0.0248	0.1409	NS
1.26	1	0.01	0.17	0.08	0.01	1.00	0.04	0.01	-0.0102	0.0221	< chance
1.40	7	0.09	0.02	5.02	1.00	1.00	0.00	0.04	-0.0005	0.0834	NS
1.54	0	0.00	0.08	0.00	0.00	0.58	0.02	0.01	0	0	< chance
1.68	2	0.03	0.03	0.81	0.16	0.16	0.01	0.04	-0.0109	0.0346	NS
1.82	0	0.00	0.07	0.00	0.00	0.00	0.02	0.00	0	0	< chance

F3

TABLE IV-3

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH ADULT, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
3.15	0	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	NS
3.50	1	0.02	0.03	0.69	0.17	0.17	0.01	0.01	-0.0107	0.0225	NS
3.85	1	0.02	0.03	0.74	0.18	0.19	0.01	0.01	-0.0107	0.0225	NS
4.20	3	0.07	0.22	0.31	0.08	0.22	0.07	0.02	-0.0108	0.463	< chance
4.55	14	0.33	0.32	1.01	0.24	0.24	0.11	0.08	0.0233	0.1424	NS
4.90	32	0.74	1.00	0.74	0.18	0.62	0.33	0.19	0.1047	0.2740	< chance
5.25	43	1.00	0.24	4.15	1.00	1.00	0.08	0.25	0.1603	0.3486	> chance
5.60	39	0.91	0.51	1.78	0.43	0.78	0.17	0.23	0.1397	0.3218	NS
5.95	32	0.74	0.32	2.30	0.56	0.56	0.11	0.19	0.1047	0.2740	NS
6.30	3	0.07	0.15	0.48	0.12	0.34	0.05	0.02	-0.0108	0.0463	< chance
6.65	1	0.02	0.05	0.50	0.12	0.12	0.02	0.01	-0.0107	0.0225	NS
7.00	0	0	0.06	0.00	0.00	0.00	0.02	0.00	0.0000	0.0000	< chance

TABLE IV-4

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR MOUNTAIN WHITEFISH SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.49	50	0.07	0.92	0.08	0.02	0	0.37705	0.03406	0.01924	0.04888	< chance
0.98	703	1.00	1.00	1.00	0.20	0.20	0.41008	0.47888	0.43807	0.51969	> chance
1.47	410	0.58	0.18	3.24	0.64	0.64	0.07377	0.27929	0.24264	0.31594	> chance
1.96	44	0.06	0.16	0.39	0.08	0.82	0.0665	0.02997	0.01604	0.0439	< chance
2.45	75	0.11	0.02	5.05	1.00	1	0.00867	0.05109	0.0331	0.06908	> chance
2.94	171	0.24	0.14	1.78	0.35	0.35	0.05617	0.11649	0.09028	0.14269	> chance
3.43	5	0.01	0.02	0.38	0.08	0.08	0.00761	0.00341	-0.00135	0.00817	NS
3.92	0	0.00	0.00	0.00	0.00	0.04					NS
4.41	10	0.01	0.00	0.00	0.00	0	0	0.00681	0.00009	0.01353	> chance

TABLE IV-5

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR MOUNTAIN WHITEFISH SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.14	0	0.00	1.00	0.00	0.00	0					< chance
0.28	5	0.01	0.34	0.02	0.01	0.01	0.10891	0.00341	-0.00082	0.00764	< chance
0.42	55	0.09	0.36	0.26	0.11	0.075	0.11343	0.03749	0.0237	0.05128	< chance
0.56	77	0.13	0.35	0.38	0.15	0.16	0.11099	0.05249	0.0363	0.06867	< chance
0.70	175	0.30	0.45	0.67	0.27	0.27	0.14256	0.11929	0.09576	0.14282	NS
0.84	329	0.56	0.54	1.04	0.42	0.5	0.17152	0.22427	0.19399	0.25454	> chance
0.98	583	1.00	0.40	2.48	1.00	1	0.12759	0.39741	0.36189	0.43293	> chance
1.12	150	0.26	0.57	0.45	0.18	0.785	0.17925	0.10225	0.08026	0.12424	< chance
1.26	69	0.12	0.08	1.41	0.57	0.57	0.02663	0.04703	0.03167	0.0624	> chance
1.40	24	0.04	0.06	0.68	0.27	0.28	0.01911	0.01636	0.00715	0.02557	NS
1.54	1	0.00	0.06	0.03	0.01	0.01					< chance
1.96	0	0.00	0.17	0.00	0.00	0					< chance

TABLE IV-6

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR MOUNTAIN WHITEFISH SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
2.58	0	0.00	0.02	0.00	0.00	0					< chance
3.01	1	0.00	0.09	0.03	0.02	0.02					< chance
3.44	0	0.00	0.00	0.00	0.00	0.125					NS
3.87	17	0.04	0.04	1.04	0.61	0.25	0.01122	0.01385	0.00194	0.02577	NS
4.30	59	0.16	0.46	0.34	0.20	0.375	0.11953	0.04808	0.02628	0.06989	< chance
4.73	213	0.56	1.00	0.56	0.33	0.49	0.26033	0.17359	0.13499	0.2122	< chance
5.16	279	0.73	0.73	1.01	0.60	0.625	0.18947	0.22738	0.18467	0.2701	> chance
5.59	262	0.69	0.85	0.82	0.48	0.813	0.21999	0.21353	0.17176	0.25529	NS
6.02	380	1.00	0.59	1.69	1.00	1	0.15376	0.3097	0.26258	0.35682	> chance
6.45	17	0.04	0.18	0.25	0.15	0.15	0.0457	0.01385	0.00194	0.02577	< chance
7.40	0	0.00	0.16	0.00	0.00	0					< chance

TABLE IV-7

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR WALLEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.26	0.00	0.00	0.76	0.00	0.00	0.00	0.10	0.00	0.00	0.00	< chance
0.39	1.50	0.06	0.82	0.07	0.06	0.06	0.11	0.02	0.01	0.05	< chance
0.52	16.48	0.63	0.87	0.77	0.67	0.67	0.11	0.22	0.12	0.32	NS
0.65	26.04	1.00	1.00	1.15	1.00	1.00	0.11	0.34	0.23	0.46	> chance
0.78	12.01	0.46	0.98	0.46	0.40	0.74	0.13	0.16	0.07	0.25	NS
0.91	13.98	0.54	0.52	0.55	0.48	0.48	0.13	0.19	0.09	0.28	NS
1.04	3.48	0.13	0.52	0.26	0.22	0.38	0.07	0.05	0.00	0.10	NS
1.17	0.99	0.04	0.52	0.07	0.06	0.27	0.07	0.01	0.01	0.04	< chance
1.30	1.01	0.04	0.20	0.20	0.17	0.17	0.03	0.01	0.01	0.04	NS
1.43	0.00	0.00	0.24	0.00	0.00	0.00	0.03	0.00	0.00	0.00	< chance

TABLE IV-8

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR WALLEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.00	35.07	1.00	1.00	1.00	0.46	0.46	0.50	0.46	0.35	0.58	NS
0.06	29.92	0.85	0.85	1.00	0.46	0.73	0.42	0.40	0.28	0.51	NS
0.13	9.51	0.27	0.12	2.17	1.00	1.00	0.06	0.13	0.05	0.20	NS
0.19	0.50	0.01	0.02	0.84	0.38	0.38	0.01	0.01	-0.01	0.03	NS
0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.51	0.50	0.01	0.00	0.00	0.00	0.00	0.00	0.01	-0.01	0.03	NS
0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS

TABLE IV-9

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR WALLEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< CHANCE
0.97	0.00	0.00	0.00	0.00	0.00	0.105	0.00	0.00	0.00	0.00	NS
1.93	25.51	1.00	1.00	1.00	0.27	0.21	0.43	0.34	0.23	0.45	NS
2.90	8.99	0.35	0.29	1.21	0.32	0.315	0.13	0.12	0.04	0.20	NS
3.86	12.49	0.49	0.39	1.25	0.33	0.42	0.17	0.17	0.08	0.25	NS
4.83	12.01	0.47	0.34	1.37	0.36	0.525	0.15	0.16	0.07	0.25	NS
5.79	8.02	0.31	0.13	2.37	0.63	0.63	0.06	0.11	0.03	0.18	NS
6.76	6.98	0.27	0.07	3.76	1.00	1.00	0.03	0.09	0.02	0.16	NS
7.73	1.00	0.04	0.04	0.98	0.26	0.00	0.02	0.01	-0.01	0.04	NS
8.69	0.50	0.02	0.02	0.99	0.26	0.00	0.01	0.01	-0.01	0.03	NS
9.66	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	< chance

TABLE IV-10

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR WALLEYE SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS			
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use		Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.	
									Min.	Max.	
0.27	0.00	0.00	0.68	0.00	0.00	0.00	0.13	0.00	0.00	0.00	< chance
0.41	2.00	0.04	1.00	0.04	0.02	0.125	0.19	0.01	-0.01	0.04	< chance
0.54	14.00	0.25	0.65	0.38	0.25	0.25	0.12	0.10	0.02	0.17	NS
0.68	27.00	0.48	0.80	0.60	0.40	0.625	0.15	0.18	0.09	0.28	NS
0.81	56.00	1.00	0.73	1.38	0.92	1.00	0.14	0.38	0.26	0.50	> chance
0.95	20.00	0.36	0.49	0.73	0.49	1.00	0.09	0.14	0.05	0.22	NS
1.08	11.00	0.20	0.32	0.61	0.41	1.00	0.06	0.07	0.01	0.14	NS
1.22	14.00	0.25	0.21	1.17	0.78	1.00	0.04	0.10	0.02	0.17	NS
1.35	2.00	0.04	0.05	0.75	0.50	1.00	0.01	0.01	-0.01	0.04	NS
1.49	1.00	0.02	0.01	1.50	1.00	1.00	0.00	0.01	-0.01	0.03	NS
1.62	0.00	0.00	0.05	0.00	0.00	0.50	0.01	0.00	0.00	0.00	< chance

TABLE IV-11

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR WALLEYE SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.17	0.00	0.00	1.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	< chance
0.26	1.00	0.02	0.81	0.02	0.00	0.016	0.19	0.01	-0.01	0.03	< chance
0.34	2.00	0.04	0.45	0.08	0.01	0.033	0.11	0.01	-0.01	0.04	< chance
0.43	11.00	0.21	0.46	0.45	0.05	0.049	0.11	0.07	0.01	0.14	NS
0.51	53.00	1.00	0.28	3.62	0.39	0.388	0.07	0.36	0.24	0.48	> chance
0.60	47.00	0.89	0.10	9.31	1.00	1.00	0.02	0.32	0.21	0.43	> chance
0.68	20.00	0.38	0.13	2.83	0.30	0.304	0.03	0.14	0.05	0.22	> chance
0.77	8.00	0.15	0.17	0.88	0.09	0.194	0.04	0.05	0.00	0.11	NS
0.85	4.00	0.08	0.10	0.79	0.09	0.085	0.02	0.03	-0.01	0.07	NS
0.94	1.00	0.02	0.05	0.40	0.04	0.042	0.01	0.01	-0.01	0.03	NS
1.02	0.00	0.00	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.00	< chance

TABLE IV-12

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR WALLEYE SPAWNING, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
2.93	0.00	0.00	0.27	0.00	0.00	0.00	0.04	0.00	0.00	0.00	< chance
3.51	1.00	0.02	0.64	0.04	0.02	0.13	0.10	0.01	-0.01	0.03	< chance
4.10	12.00	0.29	0.69	0.42	0.26	0.26	0.10	0.08	0.02	0.15	NS
4.68	33.00	0.79	1.00	0.79	0.49	0.49	0.15	0.22	0.12	0.33	NS
5.27	42.00	1.00	0.87	1.16	0.72	1.00	0.13	0.29	0.18	0.40	> chance
5.85	26.00	0.62	0.61	1.01	0.63	1.00	0.09	0.18	0.08	0.27	NS
6.44	21.00	0.50	0.45	1.12	0.70	1.00	0.07	0.14	0.06	0.23	NS
7.02	9.00	0.21	0.25	0.84	0.53	1.00	0.04	0.06	0.00	0.12	NS
7.61	2.00	0.05	0.19	0.25	0.15	1.00	0.03	0.01	-0.01	0.04	NS
8.20	1.00	0.02	0.01	1.60	1.00	1.00	0.00	0.01	-0.01	0.03	NS
8.78	0.00	0.00	0.07	0.00	0.00	0	0.01	0.00	0.00	0.00	< chance

TABLE IV-13

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR GOLDEYE ADULT, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.43	0.00	0.00	0.98	0.00	0.00	0.00	0.22	0.00	0.00	0.00	< chance
0.65	8.00	0.20	0.76	0.26	0.05	0.05	0.17	0.05	-0.00	0.10	< chance
0.86	0.00	0.00	0.39	0.00	0.00	0.169	0.09	0.00	0.00	0.00	< chance
1.08	10.00	0.25	0.17	1.51	0.29	0.289	0.04	0.06	0.01	0.11	NS
1.29	15.00	0.38	0.25	1.50	0.29	0.463	0.06	0.09	0.03	0.16	NS
1.51	40.00	1.00	0.30	3.34	0.64	0.638	0.07	0.24	0.15	0.34	> chance
1.72	40.00	1.00	0.46	2.15	0.41	0.819	0.10	0.24	0.15	0.34	> chance
1.94	37.00	0.93	0.18	5.24	1.00	1.00	0.04	0.22	0.13	0.32	> chance
2.15	11.00	0.28	0.00	0.00	0.00	0.00	0.00	0.07	0.01	0.12	> chance
2.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
2.58	4.00	0.10	0.00	0.00	0.00	0.00	0.00	0.02	-0.01	0.06	NS
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS

TABLE IV-14

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR GOLDEYE ADULT, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
								Actual Use			
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Prop. of Use	95% Conf. Int.		Significance of Diff.
									Min.	Max.	
0.00	6.00	0.10	0.23	0.44	0.25	0.254	0.04	0.04	-0.01	0.08	NS
0.10	8.00	0.13	0.34	0.38	0.22	0.261	0.07	0.05	0.00	0.10	NS
0.19	4.00	0.07	0.77	0.08	0.05	0.267	0.15	0.02	-0.01	0.06	< chance
0.29	22.00	0.36	1.00	0.36	0.21	0.274	0.19	0.13	0.06	0.21	NS
0.38	27.00	0.44	0.92	0.48	0.28	0.281	0.18	0.16	0.08	0.25	NS
0.48	61.00	1.00	0.58	1.72	1.00	1.00	0.11	0.37	0.26	0.48	> chance
0.57	18.00	0.30	0.45	0.66	0.38	0.91	0.09	0.11	0.04	0.18	NS
0.67	10.00	0.16	0.12	1.41	0.82	0.819	0.02	0.06	0.01	0.11	NS
0.76	8.00	0.13	0.28	0.47	0.27	0.546	0.05	0.05	0.00	0.10	Ns
0.86	1.00	0.02	0.32	0.05	0.03	0.273	0.06	0.01	-0.01	0.02	< chance
0.96	0.00	0.00	0.21	0.00	0.00	0.00	0.04	0.00	0.00	0.00	< chance

TABLE IV-15

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR GOLDEYE ADULT, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
2.04	0.00	0.00	0.11	0.00	0.00	0.00	0.03	0.00	0.00	0.00	< chance
2.73	1.00	0.03	0.09	0.29	0.03	0.0235	0.02	0.01	-0.01	0.02	NS
3.41	18.00	0.49	0.99	0.49	0.05	0.047	0.24	0.11	0.04	0.18	< chance
4.09	18.00	0.49	1.00	0.49	0.05	0.135	0.24	0.11	0.04	0.18	< chance
4.77	10.00	0.27	0.60	0.45	0.04	0.224	0.15	0.06	0.01	0.12	< chance
5.45	22.00	0.59	0.18	3.24	0.31	0.312	0.04	0.13	0.06	0.21	> chance
6.13	37.00	1.00	0.10	10.40	1.00	1.00	0.02	0.22	0.13	0.32	> chance
6.81	37.00	1.00	0.58	1.73	0.17	0.777	0.14	0.22	0.13	0.32	NS
7.49	13.00	0.35	0.19	1.89	0.18	0.554	0.05	0.08	0.02	0.14	NS
8.18	7.00	0.19	0.05	3.44	0.33	0.331	0.01	0.04	-0.00	0.09	NS
8.86	2.00	0.05	0.03	1.97	0.19	0.189	0.01	0.01	-0.01	0.04	NS
9.54	0.00	0.00	0.17	0.00	0.00	0.00	0.04	0.00	0.00	0.00	< chance

TABLE IV-16

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR GOLDEYE JUVENILE, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
								Actual Use			
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Prop. of Use	95% Conf. Int.		Significance of Diff.
									Min.	Max.	
0.54	0.00	0.00	0.79	0.00	0.00		0.15	0.00	0.00	0.00	< chance
0.27	4.00	0.11	0.63	0.18	0.06		0.12	0.03	-0.01	0.06	< chance
0.90	0.00	0.00	0.31	0.00	0.00		0.06	0.00	0.00	0.00	< chance
1.08	9.00	0.26	0.16	1.65	0.55		0.03	0.06	0.00	0.11	NS
1.26	16.00	0.46	0.29	1.58	0.53		0.06	0.10	0.03	0.17	NS
1.44	25.00	0.71	0.28	2.59	0.87		0.05	0.16	0.07	0.24	> chance
1.62	31.00	0.89	0.30	2.98	1.00		0.06	0.19	0.10	0.29	> chance
1.80	28.00	0.80	0.52	1.55	0.52		0.10	0.18	0.09	0.26	NS
1.98	35.00	1.00	0.00	0.00	0.00		0.00	0.22	0.12	0.32	> chance
2.17	11.00	0.31	0.00	0.00	0.00		0.00	0.07	0.01	0.13	> chance
2.35	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	NS

TABLE IV-17

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR GOLDEYE JUVENILE, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.00	4.00	0.07	0.26	0.26	0.14	0.139	0.04	0.03	-0.01	0.06	NS
0.09	4.00	0.07	0.30	0.23	0.12	0.166	0.05	0.03	-0.01	0.06	NS
0.18	2.00	0.03	0.88	0.04	0.02	0.194	0.15	0.01	-0.01	0.04	< chance
0.26	15.00	0.25	0.79	0.32	0.17	0.221	0.14	0.09	0.03	0.16	NS
0.35	16.00	0.27	1.00	0.27	0.14	0.249	0.17	0.10	0.03	0.17	< chance
0.44	30.00	0.51	0.97	0.52	0.28	0.276	0.17	0.19	0.10	0.28	NS
0.53	59.00	1.00	0.53	1.90	1.00	1.00	0.09	0.37	0.26	0.48	> chance
0.61	13.00	0.22	0.19	1.19	0.63	0.738	0.03	0.08	0.02	0.14	NS
0.70	15.00	0.25	0.28	0.90	0.48	0.477	0.05	0.09	0.03	0.16	NS
0.79	1.00	0.02	0.30	0.06	0.03	0.238	0.05	0.01	-0.01	0.02	< chance
0.88	0.00	0.00	0.23	0.00	0.00	0.00	0.04	0.00	0.00	0.00	< chance

TABLE IV-18

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR GOLDEYE JUVENILE, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
2.65	0.00	0.00	0.07	0.00	0.00	0.00	0.02	0.00	0.00	0.00	< chance
3.31	5.00	0.13	0.82	0.15	0.01	0.039	0.21	0.03	-0.01	0.07	< chance
3.97	14.00	0.35	1.00	0.35	0.03	0.078	0.25	0.09	0.02	0.15	< chance
4.63	6.00	0.15	0.61	0.24	0.02	0.118	0.15	0.04	-0.01	0.08	< chance
5.29	18.00	0.45	0.23	1.94	0.16	0.157	0.06	0.11	0.04	0.19	NS
5.95	31.00	0.78	0.06	12.38	1.00	1.00	0.02	0.19	0.10	0.29	> chance
6.62	40.00	1.00	0.56	1.78	0.14	0.77	0.14	0.25	0.15	0.35	> chance
7.28	24.00	0.60	0.18	3.33	0.27	0.54	0.05	0.15	0.07	0.23	> chance
7.94	18.00	0.45	0.12	3.87	0.31	0.312	0.03	0.11	0.04	0.19	>chance
8.60	3.00	0.08	0.00	0.00	0.00	0.00	0.00	0.02	-0.01	0.05	NS
9.26	0.00	0.00	0.19	0.00	0.00	0.00	0.05	0.00	0.00	0.00	< chance

TABLE IV-19

HABITAT USE AND AVAILABILITY DATA FOR DEPTH FOR GOLDEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.26	31.00	0.54	0.58	0.93	0.29	0.286	0.22	0.20	0.11	0.29	NS
0.52	57.00	1.00	1.00	1.00	0.31	0.307	0.38	0.37	0.26	0.48	NS
0.78	26.00	0.46	0.60	0.76	0.23	0.563	0.23	0.17	0.08	0.26	NS
1.04	15.00	0.26	0.10	2.67	0.82	0.819	0.04	0.10	0.03	0.17	NS
1.30	8.00	0.14	0.21	0.67	0.21	0.879	0.08	0.05	0.00	0.10	NS
1.56	6.00	0.11	0.10	1.02	0.31	0.939	0.04	0.04	-0.01	0.08	NS
1.82	3.00	0.05	0.02	3.26	1.00	1.00	0.01	0.02	-0.01	0.05	NS
2.08	5.00	0.09	0.00	0.00	0.00	0.00	0.00	0.03	-0.01	0.07	NS
2.34	2.00	0.04	0.00	0.00	0.00	0.00	0.00	0.01	-0.01	0.04	NS
2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS

TABLE IV-20

HABITAT USE AND AVAILABILITY DATA FOR VELOCITY FOR GOLDEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (m/s)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
0.00	146.00	1.00	1.00	1.00	1.00	1.00	0.12	0.95	0.90	1.01	> chance
0.02	3.00	0.02	0.03	0.65	0.65	0.653	0.00	0.02	-0.02	0.06	NS
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.06	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	< chance
0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< chance
0.10	3.00	0.02	0.10	0.00	0.00	0.200	0.01	0.02	-0.02	0.06	NS
0.12	0.00	0.00	0.09	0.20	0.20	0.00	0.01	0.00	0.00	0.00	< chance
0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
0.16	0.00	0.00	0.12	0.00	0.00	0.00	0.02	0.00	0.00	0.00	< chance
0.17	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	-0.01	0.03	NS
0.19	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	< chance

TABLE IV-21

HABITAT USE AND AVAILABILITY DATA FOR SUBSTRATE FOR GOLDEYE FRY, WITH PREFERENCE ANALYSIS AND BONFERRONI RESULTS, RED DEER RIVER

HABITAT PREFERENCE ANALYSIS							BONFERRONI ANALYSIS				
Bin (code)	Use Freq.	Norm. Use	Norm. Avail.	Habitat Pref.	Norm. Pref.	Suitability Coordinates	Expected Prop. of Use	Actual Use			Significance of Diff.
								Actual Prop. of Use	95% Conf. Int.		
									Min.	Max.	
1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS
1.60	45.00	0.43	0.02	28.08	1.00	0.50	0.01	0.29	0.19	0.04	> chance
2.13	105.00	1.00	1.00	1.00	0.04	1.00	0.75	0.69	0.58	0.80	NS
2.66	0.00	0.00	0.18	0.00	0.00	0.50	0.13	0.00	0.00	0.00	< chance
3.20	0.00	0.00	0.04	0.00	0.00	0.00	0.03	0.00	0.00	0.00	< chance
3.73	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00	0.00	< chance
4.26	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	NS
4.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	< chance
5.33	0.00	0.00	0.03	0.00	0.00	0.00	0.02	0.00	0.00	0.00	< chance
5.86	3.00	0.03	0.04	0.64	0.02	0.00	0.03	0.02	-0.01	0.05	NS
6.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NS

APPENDIX V

HABITAT/FLOW ANALYSIS FOR THE RED DEER RIVER

APPENDIX V

HABITAT/FLOW ANALYSIS FOR THE RED DEER RIVER

TABLE V-1

FLOW (IN M^3/S) VERSUS AQUATIC HABITAT AND FISH WEIGHTED USABLE AREA (IN M^2) RELATIONSHIPS FOR THE RED DEER RIVER, BASED ON PHABSIM ANALYSIS. F = FRY, J = JUVENILE, A = ADULT, AND S = SPAWNER.

Reach 1

Flow	Aquatic habitat	Walleye				Goldeye		
		F	J	A	S	F	J	A
4.25	18590	321	1497	1554	0	162	17	13
8.5	23055	374	1866	2460	0	63	41	42
12.7	26417	291	1760	3287	0	52	82	85
18.4	27934	202	1478	4272	0	30	152	128
34.6	34247	208	1581	3679	0	47	246	250
72.6	40469	54	775	2698	0	19	241	192
111	43825	19	741	2015	0	20	209	241
190	46586	10	496	2465	4	47	25	61
269	47773	1	24	827	5	2	121	318
425	48708	0	24	135	138	0	41	55
566	48773	0	0	45	317	0	217	181

Reach 2

Flow	Aquatic habitat	Walleye				Goldeye		
		F	J	A	S	F	J	A
2.83	16764	1575	5305	5001	0	1	273	285
7.08	21241	1581	6301	6131	0	65	389	400
14.2	24268	970	7053	7132	0	122	520	532
20.4	26210	406	6739	7882	0	154	621	629
59.6	30631	17	910	4354	0	6	2507	2484
98.7	31593	16	596	1522	0	13	1019	1278
188	33415	27	354	1662	0	65	209	139
278	34785	0	0	9	1	0	1	7
425	36573	0	2	48	0	0	2	2
566	37593	0	0	32	0	0	4	5

Reach 3

Flow	Aquatic habitat	Brown trout		Mountain whitefish				Walleye		
		J	A	F	J	A	S	F	J	A
4.25	31148	1033	628	17222	13439	0	0	6391	1138	1530
8.5	34920	2109	1325	21224	18145	0	0	6452	2709	3164
12.7	36517	3396	2105	23412	21255	0	0	3241	4517	4880
19.4	37621	5495	3562	25402	24265	0	6	630	6531	7279
54.5	38331	15627	13032	27825	32853	261	383	0	912	13066
89.7	38963	21299	14439	22351	33706	1138	1327	0	20	1273
192	40030	10818	4425	6601	19159	7009	5102	0	13	76
294	40579	2377	710	1881	8968	5725	2673	0	0	0
424	40796	1056	280	1022	3221	2049	415	0	0	0
566	40804	577	168	351	1959	487	94	0	0	0

Reach 4

Flow	Aquatic habitat	Brown trout				Mountain whitefish				Walleye
		F	J	A	S	F	J	A	S	A
4.25	8508	4590	782	258	1188	2987	3269	2	9	1960
8.5	10019	3867	1730	613	1349	5728	5432	21	55	1981
12.7	10183	3477	1584	636	2569	4841	4922	114	153	1580
19	9804	3468	2189	752	2859	5082	5652	251	275	990
44	15805	2222	2816	619	5728	4984	8173	863	1110	188
69	19022	2955	2365	195	5500	4530	8694	2049	1048	168
132	28630	6408	2468	188	6325	6532	9775	1917	623	297
194	32961	6009	4213	389	3883	5371	13584	2460	767	0
283	33624	681	3543	820	1834	2739	14231	2707	674	0
425	33724	60	1008	273	193	374	7065	1039	184	0

APPENDIX VI

FISH HABITAT DATA DECKS FOR THE RED DEER RIVER REACHES AND THEIR STORAGE FILE NAMES

TABLE VI-I
HABITAT SUITABILITY CURVES FOR FISH LIFE STAGES

(Page 1 of 4)

Habitat Suitability Curves for Brown Trout

FRY

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	0.00	1.00
0.03	0.38	0.20	0.19	8.00	1.00
0.18	1.00	0.40	1.00		
0.27	1.00	0.49	1.00		
0.37	0.47	0.70	0.82		
0.88	0.00	1.40	0.00		

JUVENILE

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.58	0.00	0.00	N/A	N/A
0.03	0.88	0.47	1.00	N/A	N/A
0.15	1.00	1.25	1.00	N/A	N/A
0.30	1.00	1.40	0.66	N/A	N/A
0.46	0.70	1.72	0.66	N/A	N/A
0.61	0.26	1.83	0.50	N/A	N/A
1.07	0.05	3.00	0.50	N/A	N/A
1.31	0.00			N/A	N/A

ADULT

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.20	0.00	0.00	N/A	N/A
0.01	0.50	0.49	0.87	N/A	N/A
0.31	1.00	0.61	1.00	N/A	N/A
0.65	1.00	1.77	1.00	N/A	N/A
0.92	0.68	1.99	0.63	N/A	N/A
1.07	0.33	2.43	0.63	N/A	N/A
1.22	0.07	2.65	0.50	N/A	N/A
1.25	0.00	3.00	0.50	N/A	N/A

SPAWNING

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.00	0.11	0.10	1.00	0.00
0.23	0.10	0.21	1.00	3.40	0.00
0.47	1.00	0.51	1.00	3.46	0.03
0.73	1.00	0.58	0.74	3.63	0.80
0.84	0.96	1.22	0.74	4.12	1.00
0.95	0.50	1.28	0.10	4.98	1.00
1.19	0.50	1.50	0.10	5.51	0.10
1.31	0.00	2.00	0.10	6.03	0.00

TABLE VI-I
HABITAT SUITABILITY CURVES FOR FISH LIFE STAGES

(Page 2 of 4)

Habitat Suitability Curves for Goldeye

FRY

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	1.00	0.00	0.00	0.00	0.00
0.02	0.84	0.26	0.29	0.16	0.00
0.04	0.68	0.52	0.31	0.33	0.50
0.06	0.52	0.78	0.56	0.49	1.00
0.08	0.36	1.04	0.82	0.65	0.50
0.10	0.20	1.30	0.88	0.81	0.00
0.12	0.10	1.56	0.94		
0.14	0.00	1.82	1.00		
		2.08	0.00		

JUVENILE

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.14	0.00	0.00	0.00	0.00
0.09	0.17	0.54	0.00	0.81	0.00
0.18	0.19	0.72	0.18	1.01	0.04
0.26	0.22	0.90	0.37	1.21	0.08
0.35	0.25	1.08	0.55	1.41	0.12
0.44	0.28	1.26	0.77	1.61	0.16
0.53	1.00	1.44	1.00	1.81	1.00
0.61	0.74	1.62	1.00	2.02	0.77
0.70	0.48	1.80	1.00	2.22	0.54
0.79	0.24	1.98	1.00	2.42	0.31
0.88	0.00	2.17	0.50	2.62	0.00

ADULT

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.25	0.00	0.00	0.00	0.00
0.10	0.26	0.43	0.00	0.62	0.00
0.19	0.27	0.65	0.05	0.83	0.02
0.29	0.27	0.86	0.17	1.04	0.05
0.38	0.28	1.08	0.29	1.25	0.14
0.48	1.00	1.29	0.46	1.45	0.22
0.57	0.91	1.51	0.64	1.66	0.31
0.67	0.82	1.72	0.82	1.87	1.00
0.76	0.55	1.94	1.00	2.08	0.78
0.86	0.27	2.15	0.00	2.28	0.55
0.96	0.00			2.49	0.33

TABLE VI-I
HABITAT SUITABILITY CURVES FOR FISH LIFE STAGES
(Page 3 of 4)

Habitat Suitability Curves for Mountain Whitefish

FRY

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	1.00	0.00	0.00	N/A	N/A
0.08	1.00	0.18	0.05	N/A	N/A
0.38	0.40	0.46	1.00	N/A	N/A
0.46	0.30	0.80	1.00	N/A	N/A
0.61	0.15	0.92	0.77	N/A	N/A
0.91	0.10	1.04	0.77	N/A	N/A
1.07	0.00	1.38	0.25	N/A	N/A
		1.50	0.25	N/A	N/A
		1.62	0.05	N/A	N/A
		1.83	0.00	N/A	N/A

JUVENILE

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	N/A	N/A
0.12	0.60	0.09	0.29	N/A	N/A
0.37	1.00	0.74	1.00	N/A	N/A
0.46	1.00	1.32	1.00	N/A	N/A
0.59	0.38	1.48	0.58	N/A	N/A
0.91	0.11	1.55	0.50	N/A	N/A
1.22	0.00	2.00	0.50	N/A	N/A

ADULT

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	N/A	N/A
0.59	1.00	0.49	0.00	N/A	N/A
1.48	1.00	0.99	1.00	N/A	N/A
1.73	0.00	3.00	1.00	N/A	N/A

SPAWNING

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	0.00	0.00
0.74	1.00	0.69	1.00	0.66	0.00
0.99	1.00	2.22	1.00	0.79	0.00
1.58	0.00	3.95	0.00	0.92	0.02
				1.05	0.12
				1.18	0.25
				1.31	0.37
				1.44	0.49
				1.57	0.62
				1.70	0.81

TABLE VI-I
HABITAT SUITABILITY CURVES FOR FISH LIFE STAGES

(Page 4 of 4)

Habitat Suitability Curves for Walleye

FRY

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.46	0.00	0.00	0.00	0.00
0.06	0.73	0.13	0.00	0.30	0.11
0.13	1.00	0.26	0.00	0.59	0.21
0.19	0.38	0.39	0.06	0.88	0.32
0.25	0.00	0.52	0.67	1.18	0.42
		0.65	1.00	1.47	0.53
		0.78	0.74	1.76	0.63
		0.91	0.48	2.06	1.00
		1.00	0.38	2.94	0.00

JUVENILE

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	0.00	1.00
0.12	0.60	0.25	0.27	0.30	1.00
0.37	1.00	0.74	1.00	3.05	1.00
0.46	1.00	1.32	1.00	4.00	1.00
0.59	0.38	1.48	0.58		
0.91	0.11	1.55	0.10		
1.22	0.00	3.05	0.00		

ADULT

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	1.00	0.00	0.00	0.00	0.20
0.25	1.00	0.62	0.00	0.19	0.20
0.52	0.00	1.09	1.00	0.38	0.37
		2.26	1.00	0.48	1.00
		2.50	0.50	0.50	1.00

SPAWNING

VELOCITY (m/s)	SUITABILITY	DEPTH (m)	SUITABILITY	CHANNEL INDEX	SUITABILITY
0.00	0.00	0.00	0.00	0.00	0.00
0.26	0.00	0.81	1.00	0.89	0.00
0.51	1.00	1.08	0.50	1.25	1.00
0.68	1.00	1.90	0.50	1.61	1.00
1.02	0.00	2.00	0.50	2.68	0.00

TABLE VI-2

The IOC files used to identify fish life stages for HABTAE (PHABSIM) analysis. 'SUB'=substratum data and 'ADU', 'JUV', and 'FRY' refer to cover data for adult, juvenile, and fry trout, respectively. The IOC95 and IOC96 files were based on different FISHCRV data sets (see Table VI-1).

IOC file contents	File name (floppy disk)
FISHCRV.95	
IOC 00000100000000200000000000000000000000000 HEADER 5 CURVES 111201 111202 111301 111302 111303	**IOC95\IOCSUB12.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 3 CURVES 111101 111102 111201	**IOC95\IOCSUB3.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 2 CURVES 111101 111102	**IOC95\IOCSUB4.DAT**
FISHCRV.96	
IOC 00000100000000200000000000000000000000000 HEADER 2 CURVES 111301 111302	**IOC96\IOCSUB12.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 4 CURVES 111201 111202 111301 111302	**IOC96\IOCSUB3.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 4 CURVES 111104 111201 111202 111302	**IOC96\IOCSUB4.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 1 CURVES 111103	**IOC96\IOCADU34.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 1 CURVES 111102	**IOC96\IOCJUV34.DAT**
IOC 00000100000000200000000000000000000000000 HEADER 1 CURVES 111101	**IOC96\IOCFRY4.DAT**

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 1 of 6)

The files were for low (R4LOCAL.IFG) versus medium flow (R4MDCAL.IFG) simulation, respectively

```
velocity calibration deck t1 to t6 reach 4
rdifm     23/1/93       JJH
IOC                  10001000000010000000
QARD               1059
QARD               1236
XSEC                  0 0.00.50                  318.1          0.003
                      0 0.0329.2       9.0329.2       9.1325.7       13.1324.4      18.0322.6      23.3321.0
                      0 29.5319.9      39.4320.0      49.2319.8      59.1320.0      68.9319.4      78.7319.3
                      0 88.6319.2      98.4319.6105.0319.2111.5319.6118.1319.7124.7319.3
                      0 131.2318.5137.8318.2144.4318.1150.9318.2157.5318.6164.0319.0
                      0 170.6319.8177.2320.8179.5321.0201.1322.6203.4322.4236.2323.3
                      0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                    0          1          1          1          1          1          4.5
NS                    0          4.6        4.7        4.9        5.4        5.6        5.7
NS                    0          5.7        5.5        5.7        5.6        5.3        5.4
NS                    0          5.2        5.5        5.7        5          5          5
NS                    0          4.9        3.9        4          4          4.6        4.5
NS                    0          4.5        4          4.2        4          4
WSL                   0
CAL1                  0          320.96     671.54
VEL1                  0                                                                           0.87    1.08    0.96    0.8     1.31    1.49
VEL1                  0          1.85       1.94       1.74       2.51       3.26       4.63       4.03    4.18    3.94    3.89    4.13    3.67
VEL1                  0          2.9        0.69
CAL2                  0          322.57     2497.6
VEL2                  0
VEL2                  0
VEL2                  0
CAL3                  0          325.16     6859.5
XSEC               85.5 85.50.50                 318.1          0.0045
                   85.5 0.0329.6       5.6329.7       6.6326.0       12.5323.0      19.7321.1      23.0321.7
                   85.5 28.9321.1      36.1319.5      42.7318.6      49.2316.5      55.8314.6      62.3313.3
                   85.5 68.9312.1      75.5311.4      80.4311.5      85.3312.5      90.2313.0      95.1313.7
                   85.5 101.7315.1108.3317.3114.8318.6121.4319.0128.0319.8134.5320.5
                   85.5 5144.4321.1164.0322.3187.7323.0196.9322.9229.7323.4262.5323.2
                   85.5 275.6323.1334.0325.4
NS                 85.5          1          1          3.8        3.8        2.85       2.85
NS                 85.5          3          4          4.3        5.3        6.2        6.4
NS                 85.5          6.7        6.1        6.1        5.8        5.3        4.9
NS                 85.5          5.2        5.4        5.2        4.8        4.6        4.6
NS                 85.5          4.35       4.4        4.4        4.05       4.1        4.1
NS                 85.5          2.8        2.8
WSL                85.5
CAL1               85.5          321.12     671.54
VEL1               85.5                                                                                   0.31    0.37    0.9     0.82    1.06
VEL1               85.5          1.42       1.54       1.5        1.44       1.41       1.54       1.56    1.64    1.64    1.63    1.38    1
VEL1               85.5
CAL2               85.5          322.97     2497.6
VEL2               85.5
VEL2               85.5
VEL2               85.5
CAL3               85.5          325.38     6859.5
XSEC              177.9 92.40.40                 318.1          0.0026
                  177.9 0.0329.2       11.8328.0      12.5326.4      19.7324.4      26.2323.3      29.5321.1
```

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 2 of 6)

```
           177.9 32.8318.5     36.1316.8     39.4314.3     42.7312.6     45.9313.9     49.2312.6
           177.9 52.5311.9     55.8312.4     59.1312.2     62.3312.2     65.6312.5     68.9312.5
           177.9 75.5314.0     82.0317.0     88.6318.1     95.1319.2101.7320.3111.5321.1
           177.9 134.5322.0167.3322.5182.7323.3200.1323.2232.9323.5278.9323.5
           177.9 317.3325.2
NS         177.9        4.55          4.55          4.55           6.2           6.2           5.9
NS         177.9         5.9           5.9           5.9           6.1           6.3           6.3
NS         177.9           6           6.5          5.85          5.85          5.55          5.55
NS         177.9         5.4           4.8           4.8           4.6          4.45           4.8
NS         177.9        4.55          4.55          4.55          4.32          4.65           1.8
NS         177.9         1.8
WSL        177.9
CAL1       177.9      321 14        671 54
VEL1       177.9                                                                                       0.28      2.32      2.5      2.54      2.54      2.31
VEL1       177.9        2.23          2.17             2          1.66          1.46           1.1      0.56      0.38      0.3      0.14         0
VEL1       177.9
CAL2       177 9      323 25        2497 6
VEL2       177 9
VEL2       177 9
VEL2       177 9
CAL3       177 9      325 48        6659 5
XSEC         454 276.20 50            318 1       0 003
             454 0.0330 1      2 4330 0      2.5324 4      6 6322.2      9.0321.3      13.1318.6
             454 16 4317 3     19 7316.5     23 0316.0     26.2316.2     29.5316.4     32.8316.7
             454 36 1317 3     39 4317 3     42 7318.4     45.9318.9     49.2319.1     52.5319.4
             454 59.1319.8     65.6320.0     72.2320.4     78.7320.5     85.3320.6     91.9320.9
             454 98.4321.1105.0321.2111.5321.1118.1321.2119.4321.3150.9321.7
             454 183.7322.4216.5323 1236.2323.5249.3323.9282.2324.3323.2324.6
             454 345.1325.7360.9326.6
NS           454           1             1             1           1.5           3.7             6
NS           454         6.1           5.6             7           7.4           6.5             7
NS           454         6.1             5           4.8           4.7           5.4           5.5
NS           454         4.7           5 2           5.2           4.7           4.7           4.8
NS           454         4.8           4.9          4.75          4.75          4.65          4.95
NS           454         4.9             5             5           4.8           1.4             1
NS           454           1             1
WSL          454
CAL1         454      321.27        671.54
VEL1         454                                                                  2.92      4.59      4.76      5.33      5.06      4.59      4.02
VEL1         454        3.61          3.05          2.56          2.62          2.58          2.23      1.77      1.15      0.82      0.66      0.36      0.16
VEL1         454           0             0             0             0
VEL1         454
CAL2         454      323.55        2497.6
VEL2         454
VEL2         454
VEL2         454
VEL2         454
CAL3         454      326.02        6859.5
XSEC         732 277.90.50            319.1      0.0027
             732 0.0327.4      3.6327.7      3.7324.6      4.9324.6      6.2324.0      8.2322.2
             732 10.2321.9     13.1320.3     19.7319.1     26.2319.5     32.8319.7     39.4319.9
             732 45.9320.3     52.5320.0     59.1319.9     65.6319.7     72.2319.9     78.7320.2
             732 85.3320.3     91.8320.1     98.4320.1108.3320.3118.1320.4128.0320.3
             732 137.8320.5147.6320.9157.5321.3167.3321.8169.9321.9196.9322.7
             732 229.7323.6237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
```

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 3 of 6)

```
NS        732         1       1     1.4       1       1       1
NS        732       2.2       3     4.2     4.3     5.3     5.4
NS        732       5.4     4.8     5.1     5.4     5.2     5.7
NS        732       5.7     5.7     5.7     5.5     5.4     4.3
NS        732       4.2     4.4     4.4     4.4     3.9       4
NS        732       3.9     3.9     3.9       1       1       1
WSL       732
CAL1      732    321.91  671.54
VEL1      732                                                            1.52    2.59    2.21    2.21    2.46
VEL1      732       2.7    2.63    2.63    2.49    2.58    2.27    2.52    2.21    1.96    2.02    2.11       2
VEL1      732      1.61     1.4    0.91       0
CAL2      732    324.03  2497.6
VEL2      732
VEL2      732
VEL2      732
CAL3      732    326.43  6659.5
VEL3      732
VEL3      732
VEL3      732
XSEC      923.4 191.40.00      319.1       0.001
          923.4 0.0328.3      12.8324.2    16.4322.1    22.5316.9    23.0319.5    36.1316.5
          923.4 42.7316.7     49.2317.4    55.8318.1    62.3318.5    68.9319.0    75.5319.6
          923.4 82.0319.5     88.6319.5    95.1319.6101.7319.7108.3320.1114.8320.3
          923.4 121.4320.4128.0320.8134.5321.1141.1321.4147.6321.7154.9322.1
          923.4 164.0322.6180.4323.4193.9324.2196.9324.4229.7326.2262.5326.6
          923.4 282.2325.2364.2326.5374.0326.6
NS        923.4     5.2     5.2    5.38    5.75     5.7     5.5
NS        923.4     5.8     5.6     5.4     5.4     4.6    4.55
NS        923.4    4.45    4.55     4.9     4.9       5     4.8
NS        923.4     4.8     4.4     4.3       4    4.85    4.85
NS        923.4     4.9     4.9     4.5     4.3     4.4     4.5
NS        923.4       1       1       1
WSL       923.4
CAL1      923.4  321.93  671.54
VEL1      923.4                            1.32    1.67    1.78    1.78    1.72     1.7    1.74    1.73     1.7
VEL1      923.4    1.71    1.46    1.28    1.35    1.08    1.13    0.83    0.74    0.68    0.39    0.17
VEL1      923.4
CAL2      923.4  324.24  2497.6
VEL2      923.4
VEL2      923.4
VEL2      923.4
CAL3      923.4  326.54  6659.5
VEL3      923.4
VEL3      923.4
VEL3      923.4
ENDJ
```

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 4 of 6)

```
med flow Red Deer River t1 to t6 reach 4
velocity    calibration
IOC                 10001000000010000000
QARD               1472
QARD               2574
XSEC                   0 0.00.50             318.3          0
                       0 0.0329.2     9.0329.2     9.1325.7     13.1324.4    18.0322.6    23.3321.1
                       0 29.5320.1    39.4320.3    49.2320.1    59.1320.2    68.9320.0    78.7319.6
                       0 88.6319.5    98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                       0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                       0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                       0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                     0         1         1      0.05         1         1         1       4.5
NS                     0       4.6       4.7       4.9       5.4       5.8       5.7
NS                     0       5.7       5.5       5.7       5.6       5.3       5.4
NS                     0       5.2       5.5       5.7         5         5         5
NS                     0       4.9       3.9         4         4       4.6       4.5
NS                     0       4.5         4       4.2         4         4
WSL                    0
CAL1                   0    320.96    671.54
CAL2                   0    322.57    2497.6
VEL2                   0                                                    4.43      4.87      4.92      5.13      5.07      5.79      5.36
VEL2                   0      5.04      5.61      6.19      5.49      4.99      5.24      6.23      5.94      5.82      5.05      5.36      4.89
VEL2                   0      4.83      3.51      3.22
CAL3                   0    325.16    6859.5
XSEC                85.5 85.50.50            318.3          0
                    85.5 0.0329.6     5.6329.7     6.6326.0     12.5323.0    19.7320.8    23.0321.1
                    85.5 28.9321.5    36.1318.4    42.7318.1    49.2316.7    55.8315.8    62.3314.8
                    85.5 68.9314.4    75.5315.1    80.4315.4    85.3315.4    90.2315.4    95.1315.8
                    85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
                    85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
                    85.5 275.6323.1334.0325.4
NS                  85.5         1         1       3.8       3.8      2.85      2.85
NS                  85.5         3         4       4.3       5.3       6.2       6.4
NS                  85.5       6.7       6.1       6.1       5.8       5.3       4.9
NS                  85.5       5.2       5.4       5.2       4.8       4.6       4.6
NS                  85.5      4.35       4.4       4.4      4.05       4.1       4.1
NS                  85.5       2.8       2.8
WSL                 85.5
CAL1                85.5    321.12    671.54
CAL2                85.5    322.97    2497.6
VEL2                85.5                                          0.72      0.46      0.36      1.73      2.14      2.73       3.8      4.84
VEL2                85.5       5.5      5.19      5.06       4.8       4.7      4.83      4.83       4.7      4.66      3.91      2.47       2.8
```

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 5 of 6)

```
VEL2        85.5        1.67        1.33
CAL3        85.5      325.36      6859.5
XSEC       177.9 92.40.30         318.3           0
           177.9 0.0329.2    11.8328.0    12.5328.4    19.7324.4    26.2323.2    29.5321.2
           177.9 32.8319.2   36.1316.6    39.4314.1    42.7312.4    45.9313.4    49.2312.6
           177.9 52.5312.8   55.8313.1    59.1313.1    62.3313.1    65.6313.1    68.9313.2
           177.9 75.5313.8   82.0316.6    88.6318.7    95.1319.8101.7320.0111.5320.6
           177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
           177.9 317.3325.2
NS         177.9        4.55        4.55        4.55         6.2         6.2         5.9
NS         177.9         5.9         5.9         5.9         6.1         6.3         6.3
NS         177.9           6         6.5        5.85        5.85        5.55        5.55
NS         177.9         5.4         4.8         4.8         4.6        4.45         4.8
NS         177.9        4.55        4.55        4.55        4.32        4.65         1.8
NS         177.9         1.8
WSL        177.9
CAL1       177.9      321.14      671.54
CAL2       177.9      323.25      2497.6
VEL2       177.9                                                                    0.34        1.49         4.8        5.43        5.13        5.64        5.74
VEL2       177.9        5.87        5.77        5.53        5.41        5.19        5.21        4.66         4.1        3.83        3.44        3.37        2.88
VEL2       177.9        1.74        0.73
CAL3       177.9      325.48      6859.5
XSEC         454 276.20.50        318.3           0
             454 0.0330.1     2.5330.0     2.6323.5     6.6321.7     9.0319.6    13.1317.6
             454 16.4317.6   19.7316.5    23.0316.0    26.2316.2    29.5316.2    32.8316.7
             454 36.1317.1   39.4318.0    42.7318.6    45.9319.0    49.2319.1    54.5319.4
             454 59.1320.1   65.6320.3    70.2320.3    78.7320.8    85.3320.6    91.9321.1
             454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
             454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
             454 345.1325.7360.9326.6
NS           454           1           1           1         1.5         3.7           6
NS           454         6.1         5.8           7         7.4         6.5           7
NS           454         6.1           5         4.8         4.7         5.4         5.5
NS           454         4.7         5.2         5.2         4.7         4.7         4.8
NS           454         4.8         4.9        4.75        4.75        4.65        4.95
NS           454         4.9           5           5         4.8         1.4           1
NS           454           1           1
WSL          454
CAL1         454      321.27      671.54
CAL2         454      323.55      2497.6
VEL2         454                                           0        1.35         4.6        4.65         5.1         5.4        5.52        5.27        5.27
VEL2         454        5.12        4.67        5.02        5.06        4.92        4.88        4.96        5.01        4.96        4.55        4.42        4.04
VEL2         454        4.41        4.05        4.31           4        4.69           0           0           0
```

TABLE VI-3

HYDRAULIC DATA DECKS USED TO ESTIMATE HABITAT AVAILABILITY DURING FISH HABITAT SAMPLING

(Page 6 of 6)

```
CAL3      454        326.02       6859.5
XSEC      732 277.90.50           319.1          0
          732 0.0327.4     3.6327.7      3.7324.8      4.9324.6      6.2324.0      8.2322.2
          732 10.2321.4    13.1320.1     19.7319.1     26.2319.5     32.8319.8     39.4320.1
          732 45.9319.8    52.5319.9     59.1320.3     65.6320.1     72.2320.3     78.7320.1
          732 85.3320.3    91.9320.1     98.4320.3108.3320.3118.1320.3128.0320.5
          732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
          732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS        732             1            1           1.4             1             1             1
NS        732           2.2            3           4.2           4.3           5.3           5.4
NS        732           5.4          4.8           5.1           5.4           5.2           5.7
NS        732           5.7          5.7           5.7           5.5           5.4           4.3
NS        732           4.2          4.4           4.4           4.4           3.9             4
NS        732           3.9          3.9           3.9             1             1             1
WSL       732
CAL1      732        321.91       671.54
CAL2      732        324.03       2497.6
VEL2      732                                                                              0          0.18      1.06      3.73      4.06      4.28      4.66
VEL2      732           4.5         5.07          4.62          4.74          4.72          5.06          4.78      4.43      4.68      4.77      4.31      4.39
VEL2      732          3.99         4.24          3.93          3.79          3.95          2.58          0.08
CAL3      732        326.43       6859.5
XSEC    923.4 191.40.00           319.1          0
        923.4 0.0328.3     12.8324.2     16.4322.1     22.0318.7     23.5317.1     36.1316.2
        923.4 42.7316.6    49.2317.4     55.8318.2     62.3318.7     68.9319.2     75.5319.3
        923.4 82.0319.5    88.6319.5     95.1319.6101.7319.9108.3320.0114.8320.4
        923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
        923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
        923.4 282.2325.2364.2326.5374.0326.6
NS      923.4           5.2          5.2          5.38          5.75           5.7           5.5
NS      923.4           5.6          5.6           5.4           5.4           4.5          4.55
NS      923.4          4.45         4.55           4.9           4.9             5           4.8
NS      923.4           4.8          4.4           4.3             4          4.85          4.85
NS      923.4           4.9          4.9           4.5           4.3           4.4           4.5
NS      923.4             1            1             1
WSL     923.4
CAL1    923.4        321.93       671.54
CAL2    923.4        324.24       2497.6
VEL2    923.4                                     2.55          3.86          3.53          3.96          3.68      4.15      4.25      3.93      4.23      4.04
VEL2    923.4          3.77         3.88          3.77          3.81          3.93          3.24          2.94      2.96      2.58      2.78      2.51      2.23
VEL2    923.4          1.88         0.84
CAL3    923.4        326.54       6859.5
ENDJ
```

APPENDIX VII

HYDRAULIC DATA DECKS USED IN HABTAE (PHABSIM) ANALYSIS TO ESTIMATE INSTREAM-FLOW NEEDS FOR FISHES IN THE RED DEER RIVER REACHES

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

(Page 1 of 12)

```
low flow Red Deer River t1 to t5 reach 1
LOW     CALIBRATION FEB          4         1992
IOC           11001001000010000000
QARD          150
QARD          300
QARD          450
QARD          650
QARD         1223
XSEC            0 0.00.50             315.7      0.0006
                0 0.0327.0    6.6324.5    15.4324.4   15.7323.8   18.0323.4   19.7322.4
                0 23.0321.5   39.4319.6   55.8319.6   72.2319.8   88.6319.7105.0319.7
                0 118.1319.4131.2317.4144.4315.9157.5315.7170.6315.8183.7316.1
                0 196.9317.9210.0318.9223.1318.5236.2319.1249.3319.4260.8321.5
                0 269.0322.7275.6323.8279.2324.1348.1326.8
NS              0          1           1           1           1        1.85        1.57
NS              0       2.15           2           2           2           2           2
NS              0          2           2           2           2           2           2
NS              0          2           2        2.86         2.8        3.45        3.95
NS              0       3.37        2.57        1.83        1.83
WSL             0     318.98      319.74      320.19      320.62      321.47
CAL1            0     321.47      1223.1
VEL1            0                                                                                  1.35        1.95        2.18        2.06        1.85
VEL1            0       1.88        2.01        1.83        2.24         2.4        2.09        1.23        1.38        0.98        0.44        0.48
VEL1            0
XSEC        203.2 203.20.50           316.2      0.0006
            203.2 0.0327.4    3.3326.0    3.5323.6    9.2321.6    18.0320.7   20.7321.5
            203.2 23.0320.7   25.6321.4   36.1320.6   54.5320.9   68.9318.8   82.0318.6
            203.2 95.1318.5108.3318.5121.4318.8134.5319.2173.9319.9193.6320.3
            203.2 213.3320.3226.4319.4239.5318.2252.6316.2265.7316.2278.9317.0
            203.2 292.0317.0311.7319.0331.4321.1341.9321.5360.9321.6377.3322.1
            203.2 388.8321.6397.0321.4405.2321.2410.4321.6419.0322.6419.9323.5
            203.2 433.7325.4459.3326.9
NS          203.2          1           1           1           2           2         2.2
NS          203.2        2.2         2.2           2           2           2           2
NS          203.2          2           2           2           2           2           2
NS          203.2          2           2           2           2         4.8           5
NS          203.2        5.8         5.8         5.9         5.9         6.3         6.1
```

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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```
NS      203.2       6.1       6.1       6.1       4.6         1       1.5
NS      203.2         1         1
WSL     203.2    319.18    319.85    320.29    320.73     321.6
CAL1    203.2     321.6    1223.1
VEL1    203.2                                              0.96         0      0.76         0      1.16      1.01      1.97      1.91
VEL1    203.2      2.11         2      1.99      1.98      1.84      1.75      1.63      1.15      1.15      2.09      2.13      2.11
VEL1    203.2      1.16      0.71         0         0                                    0.27         0
VEL1    203.2
XSEC    544.5 341.30.50           319.4     0.0005
        544.5 0.0329.5     3.0328.0     6.2322.6     10.5321.8     11.5321.5     14.8321.2
        544.5 17.1321.1    29.9322.1    49.2321.7    82.0322.1114.8321.8147.6320.1
        544.5 173.9319.9200.1319.6226.4319.6252.6319.7278.9319.8305.1319.8
        544.5 331.4320.4357.6320.5383.9320.7410.1320.8436.4320.7462.6320.5
        544.5 488.8320.0515.1319.8541.3319.6567.6319.4580.7320.5593.8321.8
        544.5 595.1323.0596.8324.0599.1325.8602.0326.2602.7325.8610.6326.2
        544.5 613.8327.6
NS      544.5         1         1         1         2         2         2
NS      544.5         2         2         2         2         2       2.6
NS      544.5       2.1         2         2         2         2         2
NS      544.5       2.2       2.2         2         2         2         2
NS      544.5         2         2         2         2         2         2
NS      544.5         2         2         2         2         1         1
NS      544.5         1
WSL     544.5    320.27     320.6    320.86    321.14     321.8
CAL1    544.5     321.8    1223.1
VEL1    544.5                                                 0         0                                                                1.75
VEL1    544.5      2.14      2.11      2.09      2.16      2.04      1.86      1.86      1.59      1.24      1.12      1.12       1.3
VEL1    544.5       1.3      1.36      1.33      0.95      0.74
VEL1    544.5
XSEC    717.5 173.00.50           319.4     0.0003
        717.5 0.0328.9     8.6324.7     42.7324.4     75.5324.2102.0323.4108.3322.7
        717.5 121.4321.9141.4321.6147.6321.3154.2321.9161.1322.6163.4322.8
        717.5 190.3323.1216.5323.3241.5322.7246.1321.9262.5321.4278.9318.9
        717.5 295.3318.9311.7318.9328.1318.9344.5319.0360.9319.0377.3319.3
        717.5 393.7319.6410.1319.7426.5320.1442.9320.0459.3317.6475.7317.2
        717.5 492.1317.5508.5321.2524.9322.0534.1323.0549.5324.0559.1325.0
        717.5 562.7326.5565.0326.0566.9326.5570.2326.6
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TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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NS	717.5	1	2	2	2	2	2						
NS	717.5	2	1.8	1.8	1.8	2	2						
NS	717.5	2	2	2	2	2	2.2						
NS	717.5	2.2	2.2	2.2	2.2	2.1	2.1						
NS	717.5	2.1	2.1	2	2	2	2						
NS	717.5	3	3.8	4.1	5.1	1	1						
NS	717.5		1	1	1								
WSL	717.5	320.31	320.66	320.93	321.22	321.89							
CAL1	717.5	321.89	1223.1										
VEL1	717.5					0.96	1.94	2.19	2.38	2.17	2.34	1.71	2.1
VEL1	717.5	1.67	1.52	1.51	1.15	1.14	1.61	1.24	0				
VEL1	717.5												
XSEC	981	263.50.50	319.4	0.0002									
	981	0.0328.6	5.6326.2	6.6323.6	36.1322.7	59.1322.7	78.7322.4						
	981	96.8321.9121.4321.8141.1321.7160.8321.7183.7322.1203.4322.5											
	981	216.5323.4242.8323.3265.7322.7285.4322.4300.2322.5305.4321.9											
	981	318.2321.5331.4321.3344.5321.0357.6320.0370.7318.8383.9318.7											
	981	397.0318.7410.1318.6423.2318.0436.4317.0449.5316.4462.6315.1											
	981	475.7318.0488.8320.0502.0320.5515.4322.0524.9322.6537.4323.3											
	981	540.5326.6545.6327.4548.9327.3											
NS	981	1	1	1.7	1.8	1.8	1.6						
NS	981	1.4	1.4	1.4	1.4	1.4	1.4						
NS	981	1.5	1.4	1.6	1.4	1.3	1.3						
NS	981	1.2	1.1	1.3	1.8	1.8	1.8						
NS	981	2	2	2	2	2.95	3.4						
NS	981	3.2	4	3.7	3.75	2.25	1						
NS	981	1	1	1									
WSL	981	320.32	320.67	320.95	321.25	321.94							
CAL1	981	321.94	1223.1										
VEL1	981								0.16	0.41	0.4		
VEL1	981							0.17	0.24	0.35	0.5	0.91	1.47
VEL1	981	1.9	2.26	2.39	2.58	2.58	2.38	2.55	1.57	0.12			
VEL1	981												
ENDJ													

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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low flow Red Deer River t1 to t5 reach 2
SUBSTRA   10/9/91 (VADAS   REMOVED   NS         TYPOS       FOR         T4)
IOC          11001001000010000000
QARD         100
QARD         250
QARD         500
QARD       719.1
XSEC           0 0.00.50           316.3           0
               0 0.0323.7    14.1320.5   14.4319.9   15.4319.4   23.5318.5   29.5317.5
               0 39.4317.2   59.1316.3   78.7316.3   98.4316.9118.1317.2137.8317.5
               0 157.5317.8177.2318.1196.9318.2216.5318.5236.2318.7255.9318.7
               0 275.6318.6292.0318.5295.3318.4315.0318.1334.6317.8354.3317.1
               0 374.0316.7387.1316.4400.3316.5413.4317.2419.9317.9424.5318.5
               0 429.1319.5437.3320.7444.6322.5465.2326.2
NS             0           1         3.7         3.7         4.2        2.75         3.7
NS             0         4.4           5         3.6         3.6         3.4         3.4
NS             0         3.1         3.1         3.1         3.5         3.5         2.9
NS             0         2.9         2.9         2.9         2.9         3.1         3.5
NS             0         3.7         4.6         5.3         3.8           3         4.6
NS             0           3           1           1           1
WSL            0      317.45      317.86      318.26       318.5
CAL1           0       318.5      719.07
VEL1           0                                                                    1.56        2.16        2.95        3.05        2.63        2.46        2.27
VEL1           0           2        1.41        0.99                                                                                0.39        0.77        1.27
VEL1           0        1.49        1.51        1.44        1.17        0.92
CAL2           0      319.85     3490.03
CAL3           0      322.59        9814
XSEC       438.4 438.40.50         316.3           0
           438.4 0.0324.3    9.6322.6    20.3320.6   20.7318.8   26.2320.8   42.0318.8
           438.4 55.8318.1   68.9317.9   82.0315.2   95.1315.5108.3315.2121.4314.2
           438.4 134.5313.6147.6313.2160.8312.9173.9313.2187.0313.9200.1314.6
           438.4 213.3315.5226.4316.1239.5316.8252.6317.1265.7317.6278.9318.7
           438.4 292.7318.8304.5319.1306.4320.6308.7321.1378.0325.9
NS         438.4           1           1           1           1           1           6
NS         438.4         6.6         6.5         6.5         6.3         6.6        6.65
NS         438.4         7.3         7.2         6.4        6.55         4.7         4.3
NS         438.4        4.25         3.9         4.2           4         3.1         2.8
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TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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NS	438.4	3.1	2.9	2.9	1.3	1.3							
WSL	438.4	317.52	318.01	318.5	318.83								
CAL1	438.4	318.83	719.07										
VEL1	438.4							0.55	0.81	0.63	0.73	0.71	0.85
VEL1	438.4	0.89	1.02	1.12	1.29	1.27	1.21	1.09	1	0.75	0.51	0.42	0.23
VEL1	438.4												
CAL2	438.4	320.63	3490.03										
CAL3	438.4	323.55	9814										
XSEC	538	99.60.60	316.3	0									
	538	0.0325.4	6.6323.0	13.1319.9	15.1318.9	21.7317.1	31.5315.4						
	538	41.3313.9	51.2314.6	61.0313.6	70.9313.6	80.7313.6	90.6313.6						
	538	100.4314.3110.2313.9120.1313.6129.9312.9139.8314.3149.6313.6											
	538	159.4314.3169.3314.9179.1315.6189.0316.2198.8316.5208.7316.8											
	538	215.2317.2228.3317.9238.2318.4248.0318.9264.1320.2265.7320.7											
	538	273.3321.4334.6325.5											
NS	538	1	1	1	5.4	7.8	8.9						
NS	538	8.9	8.9	9	8.9	9.1	8.7						
NS	538	7.6	7.2	6.25	6.6	6.95	5.5						
NS	538	4.3	4.1	3.7	3.8	3.8	4						
NS	538	4	3.6	3.35	3.55	2.5	2.5						
NS	538	1.7	1.7										
WSL	538	317.52	318.02	318.52	318.86								
CAL1	538	318.85	719.07										
VEL1	538						0.41	0.46	0.72	0.87	0.63	0.84	0.83
VEL1	538	0.19	0.85	0.85	0.86	1.13	1.08	1.2	1.1	1.2	0.94	1.05	1.05
VEL1	538	0.85	0.65	0.25									
CAL2	538	320.71	3490.03										
CAL3	538	323.74	9814										
XSEC	707.3	169.40.50	316.3	0									
	707.3	0.0326.3	16.4320.9	16.7321.1	26.9319.0	29.2319.5	34.4319.0						
	707.3	49.2317.9	65.6316.6	82.0315.8	98.4315.9114.8317.2131.2318.2								
	707.3	147.6318.1164.0318.1180.4318.0196.9318.1213.3318.0229.7318.0											
	707.3	46.1317.7262.5318.1278.9318.1295.3317.9311.7317.8328.1317.5											
	707.3	344.5317.6360.9317.8377.3318.5382.2319.0410.1320.5412.7320.9											
	707.3	419.3321.4420.9321.0434.4322.6470.8327.1											
NS	707.3	3.7	3.7	3	1.5	2.1	1.5						
NS	707.3	1.9	1.9	1.9	2.1	2.4	3.5						

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, R3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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NS       707.3      3.8      4.5      3.6      3.6      3.6      4.7
NS       707.3      3.9      3.6      4.8      4.8      3.9      3.9
NS       707.3      4.4      4.4      4.8      4.9        3        3
NS       707.3        3      4.7      2.1      2.1
WSL      707.3   317.74   318.22   318.67   318.99
CAL1     707.3   318.98   719.07
VEL1     707.3                                                                     0.2      0.1        0        1     0.12
VEL1     707.3     0.59     2.27     2.95     3.23     3.39     3.31     2.39     2.89     3.02     2.95     2.27     3.35
VEL1     707.3     3.16     2.66     0.97
CAL2     707.3   320.94  3490.03
CAL3     707.3   324.25     9814
XSEC     753.8 46.50.00    317.2        0
         753.8 0.0325.8    3.3323.8    4.6322.6    21.0321.0    22.6321.4    28.5319.6
         753.8 47.6319.5   72.5319.2   82.0318.3   91.9318.0101.7318.8118.1319.2
         753.8 151.9319.7176.8319.6211.0319.2226.4318.7242.8318.2259.2318.0
         753.8 275.6317.9292.0318.1308.4317.9324.8317.9341.2317.7354.3317.7
         753.8 367.5317.2380.6317.4393.7317.5406.8317.3419.9317.6433.1318.0
         753.8 446.2318.2459.3319.1461.0319.2469.2320.8524.6329.5
NS       753.8        1        1        1        1        1      2.5
NS       753.8      2.5      2.5      1.7      2.4      3.5      3.5
NS       753.8        3      3.2      4.4      4.1      3.8      3.8
NS       753.8      3.9        4      4.6      4.6      4.2      3.8
NS       753.8      4.6      4.6      4.6      4.6      4.6      3.9
NS       753.8      4.4      4.4      4.4      3.9      3.9
WSL      753.8   318.16    318.5   318.86   319.14
CAL1     753.8   319.15   719.07
VEL1     753.8                                                                              0        0        0
VEL1     753.8                                 1.24     1.99     2.36     2.34     2.36     2.58     2.66     2.83     2.63
VEL1     753.8     2.95      2.8     2.63     2.27     1.69     1.82      1.3        0
CAL2     753.8   321.01  3490.03
CAL3     753.8   324.27     9814
ENDJ
```

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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```
RDRIFIM t1 to t4 reach 3
CALIBRATED         LOW        FLOW         23/01/93
IOC           1100100100001000000
QARD             150
QARD             300
QARD             450
QARD           684.2
XSEC               0 0.00.50            314.4       0.0024
                   0 0.0319.3     3.3318.4     4.6316.6     5.2317.0     7.5315.8     16.4315.8
                   0 27.9315.8    42.7316.3    54.8315.8    78.7315.5105.0315.1131.2315.1
                   0 157.5315.4183.7315.5210.0315.5236.2315.3262.5315.3288.7315.0
                   0 315.0314.9341.2314.6367.5314.6393.7314.6419.9314.5446.2314.4
                   0 472.4314.7498.7314.8524.9314.5551.2314.5579.1315.8585.6315.8
                   0 586.9316.1588.3318.5590.6319.3
NS                 0         1          1          1          1        1.7        1.7
NS                 0       4.6        4.6        3.4        3.9        3.4        3.4
NS                 0       4.2        4.2        4.2        4.5        4.2        4.4
NS                 0       4.9        4.9        4.8        4.8        4.3        4.8
NS                 0       4.4        4.4        4.2        3.8        4.1        4.1
NS                 0         1          1          1
WSL                0    315.25     315.46      315.6     315.75
CAL1               0    315.75     684.23
VEL1               0                                                                                             0.87      1.15      1.13
VEL1               0      0.99       0.27       0.51       0.89       0.64       2.02      2.11      2.41      2.24      2.89      2.21      3.05
VEL1               0      2.66       2.58       2.21       1.57
CAL2               0     316.6       3168
VEL2               0
VEL2               0
VEL2               0
CAL3               0    318.82      10374
VEL3               0
VEL3               0
VEL3               0
XSEC           372.6 372.60.50          314.4       0.00301
               372.6 0.0320.2     16.4318.4    23.0317.7    26.2317.2    32.8316.9    37.7316.3
               372.6 42.7314.2    52.5313.8    65.6314 0    82.0313.3    98.4313.6114.8313.2
               372.6 131.2313.3147.6312.2164.0313.0180.4313.9196.9313.2213.3313.5
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TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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      372.6 229.7314.1246.1314.0262.5314.4278.9313.8295.3313.8311.7313.4
      372.6 328.1314.3344.5314.5360.9314.7377.3315.0393.7315.1410.1316.2
      372.6 413.4316.3418.0317.7419.9317.3420.6318.9422.6320.9
NS    372.6     1.66      2.3      2.3      2.3     3.35      4.5
NS    372.6      5.3      6.9     6.25     6.25      6.2      6.5
NS    372.6      6.5      7.3      6.5      6.6     6.25      6.3
NS    372.6     5.85      5.9      6.1     6.55      7.7     5.25
NS    372.6      4.8     4.42      4.9      4.4      3.6      3.3
NS    372.6      3.5      3.5        1        1        1
WSL   372.6   315.38   315.68    315.9   316.16
CAL1  372.6   316.26   684.23
VEL1  372.6
VEL1  372.6     0.93     0.76     0.86     1.18     0.89     0.63     0.96     0.88     0.81     0.82     0.85     0.85
VEL1  372.6     0.69     0.69     0.61     0.54     0.51     0.18     0.74     0.78     0.82     0.65     0.62     0.62
CAL2  372.6   317.68   3168.8                                          0
VEL2  372.6
VEL2  372.6
VEL2  372.6
CAL3  372.6   319.86    10374
VEL3  372.6
VEL3  372.6
VEL3  372.6
XSEC  625.1 252.50.50        314.4     0.0015
      625.1 0.0320.1    6.6317.9  8.2317.2   13.5316.3   26.2314.8   39.4314.0
      625.1 52.5313.5   65.6313.2 78.7312.5  91.9313.0105.0313.5118.1313.6
      625.1 131.2314.0157.5313.7183.7314.0210.0314.1236.2313.9262.5314.4
      625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.3
      625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS    625.1        1        1      4.5      4.8      4.8      4.8
NS    625.1      5.5      5.5      4.6      4.6      4.6      4.6
NS    625.1      4.6      4.2      4.2      3.7      4.4      3.7
NS    625.1      3.7      3.4      3.4      3.4      3.5      3.3
NS    625.1      3.3        1        1        1
WSL   625.1   315.43   315.77   316.01   316.31
CAL1  625.1   316.31   684.23
VEL1  625.1
VEL1  625.1                                         0.71     0.73      0.8        1     0.99        1     0.96     0.78
                0.94     0.88     0.87     0.94     1.06     1.02     0.96     0.71     0.56     0.41     0.31
```

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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```
VEL1    625.1
CAL2    625.1      317.82      3168.8
VEL2    625.1
VEL2    625.1
VEL2    625.1
CAL3    625.1      320.16      10374
VEL3    625.1
VEL3    625.1
VEL3    625.1
XSEC    952.2 327.20.50          314.4       0.00053
        952.2 0.0321.1     2.3318.0    16.4319.3   22.6316.2   26.2317.0   32.8316.5
        952.2 49.2314.4    65.6313.3   82.0313.2   98.4312.8114.8313.0131.2313.4
        952.2 147.6313.2164.0313.9180.4313.3196.9313.2213.3313.8229.7313.8
        952.2 246.1314.0262.5314.5278.9314.8295.3315.1311.7315.5328.1315.8
        952.2 344.5315.8360.9316.1377.3316.4388.1316.5393.7316.6397.0317.1
        952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS      952.2        1         1.8        4.4        4.4        4.8        5.6
NS      952.2      5.3         5.7       6.35          7        7.6        7.6
NS      952.2        8         8.5        6.4       6.45        6.3        5.5
NS      952.2      4.5         3.8        4.2        4.1        3.9        3.4
NS      952.2      3.2         3.1       2.96       2.97       2.65          1
NS      952.2        1           1          1          1
WSL     952.2   315.51      315.89     316.17     316.51
CAL1    952.2   316.46      684.23
VEL1    952.2                                                                    0.42   0.88   0.85   0.97   1.16   1.2
VEL1    952.2      1.1        1.21       1.03       1.09       1.07       0.88   0.62   0.65   0.56   0.55   0.5    0.42
VEL1    952.2     0.24        0.22       0.09
CAL2    952.2   318.04      3168.8
VEL2    952.2
VEL2    952.2
VEL2    952.2
CAL3    952.2    320.6       10374
VEL3    952.2
VEL3    952.2
VEL3    952.2
ENDJ
```

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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```
LOW velocity calibration deck t1 to t6 reach 4
rdifm      23/1/93       JJH
IOC                   110010010000010000000
QARD                  150
QARD                  300
QARD                  450
QARD                  671
XSEC                     0 0.00.50              318.1          0.003
                         0 0.0329.2     9.0329.2      9.1325.7      13.1324.4     18.0322.6     23.3321.0
                         0 29.5319.9    39.4320.0     49.2319.8     59.1320.0     68.9319.4     78.7319.3
                         0 88.6319.2    98.4319.6105.0319.2111.5319.6118.1319.7124.7319.3
                         0 131.2318.5137.8318.2144.4318.1150.9318.2157.5318.6164.0319.0
                         0 170.6319.8177.2320.8179.5321.0201.1322.0203.4322.4236.2323.3
                         0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                       0          1          1          1          1          1        4.5
NS                       0        4.6        4.7        4.9        5.4        5.6        5.7
NS                       0        5.7        5.5        5.7        5.6        5.3        5.4
NS                       0        5.2        5.5        5.7          5          5          5
NS                       0        4.9        3.9          4          4        4.6        4.5
NS                       0        4.5          4        4.2          4          4
WSL                      0     319.99     320.37     320.64     320.96
CAL1                     0     320.96     671.54
VEL1                     0                                                                          0.87       1.08       0.96        0.8       1.31       1.49
VEL1                     0       1.85       1.94       1.74       2.51       3.26       4.63       4.03       4.18       3.94       3.89       4.13       3.87
VEL1                     0        2.9       0.69
CAL2                     0     322.57    2742.17
VEL2                     0
VEL2                     0
VEL2                     0
CAL3                     0     325.16     6659.5
XSEC                  85.5 85.50.50             318.1          0.0045
                      85.5 0.0329.6     5.6329.7      6.6326.0      12.5323.0     19.7321.1     23.0321.7
                      85.5 28.9321.1    36.1319.5     42.7318.6     49.2318.5     55.8314.6     62.3313.3
                      85.5 68.9312.1    75.5311.4     80.4311.5     85.3312.5     90.2313.0     95.1313.7
                      85.5 5101.7315.1108.3317.3114.8318.6121.4319.0128.0319.8134.5320.5
                      85.5 5144.4321.1164.0322.3167.7323.0196.9322.9229.7323.4262.5323.2
                      85.5 5275.6323.1334.0325.4
NS                    85.5          1          1        3.8        3.8       2.85       2.85
NS                    85.5          3          4        4.3        5.3        6.2        6.4
NS                    85.5        6.7        6.1        6.1        5.8        5.3        4.9
NS                    85.5        5.2        5.4        5.2        4.8        4.6        4.6
NS                    85.5       4.35        4.4        4.4       4.05        4.1        4.1
NS                    85.5        2.8        2.8
WSL                   85.5     320.04     320.46     320.78     321.11
CAL1                  85.5     321.12     671.54
VEL1                  85.5                                                                                     0.31       0.37        0.9       0.82       1.06
VEL1                  85.5       1.42       1.54        1.5       1.44       1.41       1.54       1.56       1.64       1.64       1.63       1.38          1
VEL1                  85.5
CAL2                  85.5     322.97    2742.17
VEL2                  85.5
VEL2                  85.5
VEL2                  85.5
```

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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CAL3	85.5	325.38	6859.5										
XSEC	177.9	92.40.40	318.1	0.0026									
	177.9	0.0329.2	11.8328.0	12.5326.4	19.7324.4	26.2323.3	29.5321.1						
	177.9	32.8318.5	36.1316.6	39.4314.3	42.7312.6	45.9313.9	49.2312.6						
	177.9	52.5311.9	55.8312.4	59.1312.2	62.3312.2	65.6312.5	68.9312.5						
	177.9	75.5314.0	82.0317.0	88.6318.1	95.1319.2101.7320.3111.5321.1								
	177.9	134.5322.0167.3322.5182.7323.3200.1323.2232.9323.5278.9323.5											
	177.9	317.3325.2											
NS	177.9	4.55	4.55	4.55	6.2	6.2	5.9						
NS	177.9	5.9	5.9	5.9	6.1	6.3	6.3						
NS	177.9	6	6.5	5.85	5.65	5.55	5.55						
NS	177.9	5.4	4.8	4.8	4.6	4.45	4.8						
NS	177.9	4.55	4.55	4.55	4.32	4.65	1.8						
NS	177.9	1.8											
WSL	177.9	320.05	320.47	320.77	321.14								
CAL1	177.9	321.14	671.54										
VEL1	177.9							0.28	2.32	2.5	2.54	2.54	2.31
VEL1	177.9	2.23	2.17	2	1.66	1.46	1.1	0.58	0.38	0.3	0.14	0	
VEL1	177.9												
CAL2	177.9	323.25	2742.17										
VEL2	177.9												
VEL2	177.9												
VEL2	177.9												
CAL3	177.9	325.48	6859.5										
XSEC	454	276.20.50	318.1	0.003									
	454	0.0330.1	2.4330.0	2.5324.4	6.6322.2	9.0321.3	13.1318.6						
	454	16.4317.3	19.7316.5	23.0316.0	26.2316.2	29.5316.4	32.8316.7						
	454	36.1317.3	39.4317.3	42.7318.4	45.9318.9	49.2319.1	52.5319.4						
	454	59.1319.8	65.6320.0	72.2320.4	78.7320.5	85.3320.6	91.9320.9						
	454	98.4321.1105.0321.2111.5321.1118.1321.2119.4321.3150.9321.7											
	454	163.7322.4216.5323.1236.2323.5249.3323.9282.2324.3323.2324.6											
	454	345.1325.7360.9326.6											
NS	454	1	1	1	1.5	3.7	6						
NS	454	6.1	5.8	7	7.4	6.5	7						
NS	454	6.1	5	4.8	4.7	5.4	5.5						
NS	454	4.7	5.2	5.2	4.7	4.7	4.8						
NS	454	4.8	4.9	4.75	4.75	4.65	4.95						
NS	454	4.9	5	5	4.8	1.4	1						
NS	454	1	1										
WSL	454	320.09	320.56	320.9	321.28								
CAL1	454	321.27	671.54										
VEL1	454						2.92	4.59	4.76	5.33	5.09	4.59	4.02
VEL1	454	3.61	3.05	2.56	2.62	2.56	2.23	1.77	1.15	0.82	0.66	0.36	0.16
VEL1	454	0	0	0	0								
VEL1	454												
CAL2	454	323.55	2742.17										
VEL2	454												
VEL2	454												
VEL2	454												
VEL2	454												
CAL3	454	326.02	6859.5										
XSEC	732	277.90.50	319.1	0.0027									

TABLE VII-1

FILES FOR LOW-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1LOCAL.IFG, R2LOCAL.IFG, r3LOCAL.IFG AND R4LOCAL.IFG, RESPECTIVELY

(R1 to R4 refer to the reach number)

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```
          732 0.0327.4     3.6327.7     3.7324.8     4.9324.6     6.2324.0     8.2322.2
          732 10.2321.9    13.1320.3    19.7319.1    26.2319.5    32.8319.7    39.4319.9
          732 45.9320.3    52.5320.0    59.1319.9    65.6319.7    72.2319.9    78.7320.2
          732 85.3320.3    91.9320.1    98.4320.1108.3320.3118.1320.4128.0320.3
          732 137.8320.5147.6320.9157.5321.3167.3321.8169.9321.9196.9322.7
          732 229.7323.6237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS        732           1           1         1.4           1           1           1
NS        732         2.2           3         4.2         4.3         5.3         5.4
NS        732         5.4         4.8         5.1         5.4         5.2         5.7
NS        732         5.7         5.7         5.7         5.5         5.4         4.3
NS        732         4.2         4.4         4.4         4.4         3.9           4
NS        732         3.9         3.9         3.9           1           1           1
WSL       732       320.8      321.91      321.52      321.91
CAL1      732      321.91      671.54
VEL1      732                                                                                 1.52     2.59     2.21     2.21     2.46
VEL1      732         2.7        2.63        2.63        2.49        2.58        2.27     2.52     2.21     1.96     2.02     2.11        2
VEL1      732        1.61         1.4        0.91           0
CAL2      732      324.03     2742.17
VEL2      732
VEL2      732
VEL2      732
CAL3      732      326.43      6859.5
VEL3      732
VEL3      732
VEL3      732
XSEC    923.4 191.40.00        319.1       0.001
        923.4 0.0328.3     12.8324.2    16.4322.1    22.5316.9    23.0319.5    36.1316.5
        923.4 42.7316.7    49.2317.4    55.8318.1    62.3318.5    68.9319.0    75.5319.6
        923.4 82.0319.5    88.6319.5    95.1319.6101.7319.7108.3320.1114.8320.3
        923.4 121.4320.4128.0320.8134.5321.1141.1321.4147.6321.7154.9322.1
        923.4 164.0322.6180.4323.4193.9324.2196.9324.4229.7326.2262.5326.6
        923.4 282.2325.2364.2326.5374.0326.6
NS      923.4         5.2         5.2        5.38        5.75         5.7         5.5
NS      923.4         5.8         5.6         5.4         5.4         4.5        4.55
NS      923.4        4.45        4.55         4.9         4.9           5         4.8
NS      923.4         4.8         4.4         4.3           4        4.85        4.85
NS      923.4         4.9         4.9         4.5         4.3         4.4         4.5
NS      923.4           1           1           1
WSL     923.4       320.9      321.96      321.69       322.1
CAL1    923.4      321.93      671.54
VEL1    923.4                                            1.32        1.67        1.78     1.78     1.72      1.7     1.74     1.73      1.7
VEL1    923.4        1.71        1.46        1.28        1.35        1.08        1.13     0.83     0.74     0.68     0.39     0.17
VEL1    923.4
CAL2    923.4      324.24     2742.17
VEL2    923.4
VEL2    923.4
VEL2    923.4
CAL3    923.4      326.54      6859.5
VEL3    923.4
VEL3    923.4
VEL3    923.4
ENDJ
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t5 reach 1
SUBSTRATE2           10/10/91 (VADAS REMOVED TYPOS FOR T1, T2, & T5)
IOC          1100100000001000000
QARD         2563
QARD         3903
QARD         6697
XSEC             0 0.00.50           313.2       0.0006
                 0 0.0327.0     6.6324.5    15.4324.4   15.7323.8   18.0323.4   19.0323.5
                 0 19.7323.2    23.0321.6   39.4319.2   55.8316.5   72.2315.2   88.6313.2
                 0 105.0313.5118.1314.1131.2314.5144.4314.9157.5315.6170.6315.4
                 0 183.7315.6196.9316.1210.0317.0223.1318.0236.2319.5249.3318.2
                 0 260.8321.1269.0322.6273.3323.5275.6323.8279.2324.1348.1326.8
NS               0          1           1           1           1        1.85        1.57
NS               0       2.15           2           2           2           2           2
NS               0          2           2           2           2           2           2
NS               0          2           2        2.86         2.8        3.45        3.95
NS               0       3.37        2.57        1.83        1.83
CAL1             0     321.16        1223
CAL2             0     323.54      3906.3
VEL2             0                                                                               0        0.52        1.22         1.8        3.01        3.12
VEL2             0       2.89        2.96        2.88         2.8         3.1        2.48        2.17        1.59        1.19        1.13        0.87        0.61
VEL2             0       0.59        0.08
CAL3             0     325.94        9492
XSEC         203.2 203.20.50           318       0.0006
             203.2 0.0327.4     3.3326.0    3.5323.6    9.2322.0    18.0320.2   20.7319.5
             203.2 23.0319.3    25.6319.2   36.1319.2   54.5318.8   68.9319.2   82.0318.2
             203.2 95.1318.6108.3318.9121.4319.2134.5319.0154.2319.5173.9319.6
             203.2 193.6319.4213.3319.2226.4318.0239.5318.9252.6318.9265.7318.9
             203.2 278.9318.8292.0320.0311.7321.3331.4321.6341.9321.8360.9321.7
             203.2 377.3322.1388.8321.6397.0321.6405.2321.3410.4321.6419.0323.3
             203.2 419.9323.6433.7325.4459.3326.9
NS           203.2          1           1           1           2           2         2.2
NS           203.2        2.2         2.2           2           2           2           2
NS           203.2          2           2           2           2           2           2
NS           203.2          2           2           2           2         4.8           5
NS           203.2        5.8         5.8         5.9         5.9         6.3         6.1
NS           203.2        6.1         6.1         6.1         4.6           1         1.5
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

(Page 2 of 11)

```
NS         203.2          1         1
CAL1       203.2     321.59      1223
CAL2       203.2     323.65    3906.3
VEL2       203.2                            0      0.79      2.16      1.88   2.22   2.34   2.52   2.33   2.64   2.21
VEL2       203.2       2.25      2.56    2.63      2.48      2.48      2.55   2.54   2.33   2.46   2.64   2.96   2.95
VEL2       203.2       2.69      2.34     2.6      2.79      2.62       2.2   2.85   2.66   2.57   1.39   1.34      0
VEL2       203.2          0
CAL3       203.2     326.21      9492
XSEC       544.5 341.30.50        319  0.0005
           544.5 0.0329.5    3.0328.0   6.2322.6   10.5321.8   11.5321.5   14.8321.2
           544.5 17.1321.1   26.9323.9  49.2323.2   82.0323.0114.8322.9147.6322.7
           544.5 173.9322.6200.1321.1226.4319.8252.6319.8278.9320.0305.1319.8
           544.5 331.4319.8357.6319.8383.9319.7410.1319.3436.4319.0462.6319.3
           544.5 488.8319.3515.1320.0541.3320.3567.6320.5580.7320.3593.8320.8
           544.5 595.1320.8596.8321.3599.1322.5602.0323.9602.7325.8610.6326.2
           544.5 613.8327.6
NS         544.5          1         1       1         2         2         2
NS         544.5          2         2       2         2         2       2.6
NS         544.5        2.1         2       2         2         2         2
NS         544.5        2.2       2.2       2         2         2         2
NS         544.5          2         2       2         2         2         2
NS         544.5          2         2       2         2         1         1
NS         544.5          1
CAL1       544.5      321.8      1223
CAL2       544.5      323.9    3906.3
VEL2       544.5                                                                        0   0.85   1.18   1.44   1.48
VEL2       544.5       2.03       1.9    2.29      2.47      2.46      2.51   2.69   2.48   2.99   2.64   2.64   2.17
VEL2       544.5       2.21      2.48    2.49      2.18      1.23      0.94    0.9   0.83   0.66
CAL3       544.5     326.51      9492
XSEC       717.5 173.00.50        319  0.0003
           717.5 0.0328.9    8.6324.7   42.7324.4   75.5324.2102.0324.0108.3323.9
           717.5 121.4323.6141.4323.4147.6323.3154.2323.0161.1322.9163.4322.8
           717.5 190.3322.3216.5321.9241.5321.7246.1321.5262.5321.6278.9321.6
           717.5 295.3321.4311.7321.3328.1320.7344.5319.9360.9319.4377.3319.2
           717.5 393.7319.1410.1318.1426.5317.9442.9317.6459.3316.4475.7315.8
           717.5 492.1315.5508.5318.1524.9321.4534.1322.0549.5323.0559.1324.0
           717.5 562.7326.5565.0326.0566.9326.5570.2326.6
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TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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NS	717.5	1	2	2	2	2	2						
NS	717.5	2	1.8	1.8	1.8	2	2						
NS	717.5	2	2	2	2	2	2.2						
NS	717.5	2.2	2.2	2.2	2.2	2.1	2.1						
NS	717.5	2.1	2.1	2	2	2	2						
NS	717.5	3	3.8	4.1	5.1	1	1						
NS	717.5	1	1	1	1								
CAL1	717.5	321.88	1223										
CAL2	717.5	323.98	3906.3										
VEL2	717.5						0	0.49	0.66	0.79	0.89	1.12	0.92
VEL2	717.5	1.48	1.71	1.71	1.57	1.9	2.46	2.03	2.23	2.15	2.41	2.45	2.55
VEL2	717.5	3.03	2.92	2.85	3.08	2.85	2.88	3.03	2.64	2.96	2.74	1.97	
CAL3	717.5	326.57	9492										
XSEC	981	263.50.50	319	0.0002									
	981	0.0328.6	5.6326.2	6.6324.1	36.1322.8	59.1322.8	78.7322.8						
	981	96.8322.8121.4322.5141.1322.6160.8322.5183.7322.4203.4322.2											
	981	216.5322.0242.8321.3265.7321.1285.4321.2300.2320.9305.4320.9											
	981	318.2320.9331.4319.6344.5319.2357.6318.4370.7317.6383.9317.4											
	981	397.0317.7410.1318.6423.2318.9436.4318.9449.5318.2462.6317.6											
	981	475.7317.7488.8319.6502.0321.2515.4322.4524.9323.0537.4323.9											
	981	540.5324.1545.6327.4548.9327.3											
NS	981	1	1	1.7	1.8	1.8	1.6						
NS	981	1.4	1.4	1.4	1.4	1.4	1.4						
NS	981	1.5	1.4	1.6	1.4	1.3	1.3						
NS	981	1.2	1.1	1.3	1.8	1.8	1.8						
NS	981	2	2	2	2	2.95	3.4						
NS	981	3.2	4	3.7	3.75	2.25	1						
NS	981	1	1	1									
CAL1	981	321.94	1223										
CAL2	981	324.15	3906.3										
VEL2	981				1.18	1.48	1.28	1.38	1.25	1.31	1.44	1.64	0.98
VEL2	981	1.48	1.43	2.08	2.39	2.37	2.47	1.89	2.36	2.45	2.41	2.52	2.76
VEL2	981	2.74	2.98	2.83	3.4	3.05	3	2.97	2.75	2.68	3.61	2.23	0.13
CAL3	981	326.67	9492										
ENDJ													

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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medium flow Red Deer River t1 to t5 reach 2
SUBSTRATE2        10/9/91
IOC          1100100000010000000
QARD           2103
QARD           3486
QARD           6650
XSEC               0 0.00.50      316.2        0
                   0 0.0323.7  14.1320.  14.4319.  15.4319.  23.5318.  29.5317.8
                   0 39.4317.  59.1316.  78.7316.  98.4316.6118.1317.2137.8317.4
                   0 157.5317.7177.2317.9196.9318.2216.5318.3236.2318.5255.9318.6
                   0 275.6318.6292.0318.4295.3318.4315.0318.1334.6317.6354.3316.9
                   0 374.0316.4387.1316.4400.3316.5413.4317.4419.9318.1424.5318.6
                   0 429.1319.9437.3320.7444.6322.5465.2326.2
NS                 0        1       3.7       3.7       4.2      2.75       3.7
NS                 0      4.4         5       3.6       3.6       3.4       3.4
NS                 0      3.1       3.1       3.1       3.5       3.5       2.9
NS                 0      2.9       2.9       2.9       2.9       3.1       3.5
NS                 0      3.7       4.6       5.3       3.8         3       4.6
NS                 0        3         1         1         1
CAL1               0    318.5    719.07
CAL2               0   319.85   3490.03
VEL2               0                                1.64       1.9      3.81       4.3      4.36       4.5      4.35      4.22      4.43
VEL2               0     4.12      3.81      3.03      2.72         3      2.64      2.62      2.51      2.54      2.12       3.4      3.61
VEL2               0     3.69      4.19      3.56      3.38      2.62      1.97
CAL3               0   322.59      9814
XSEC           438.4 438.40.5     316.2         0
               438.4 0.0324.3  9.8322.8  20.3320.  20.7320.  26.2320.  42.0318.5
               438.4 55.8317.  68.9317.  82.0314.  95.1315.5108.3315.6121.4314.2
               438.4 134.5314.1147.6313.5160.8313.4173.9312.8187.0314.1200.1314.9
               438.4 213.3315.6226.4316.2239.5316.8252.6317.5265.7317.8278.9318.1
               438.4 292.7318.9304.5319.8306.4320.6308.7321.1378.0325.9
NS             438.4        1         1         1         1         1         6
NS             438.4      6.6       6.5       6.5       6.3       6.6      6.65
NS             438.4      7.3       7.2       6.4      6.55       4.7       4.3
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
NS      438.4    4.25      3.9     4.2       4     3.1     2.8
NS      438.4     3.1      2.9     2.9     1.3     1.3
CAL1    438.4  318.83   719.07
CAL2    438.4  320.63  3490.03
VEL2    438.4                                   0.21    1.46     2.2     1.9    2.28    2.15    2.04    2.13
VEL2    438.4    2.33     2.53    2.58       3    3.05    3.05    2.82    2.45    2.31    2.23    1.84    1.76
VEL2    438.4    1.34     0.19
CAL3    438.4  323.55     9814
XSEC      538 99.60.60   316.2       0
          538 0.0325.4 6.6323.0 13.1318. 15.1318. 21.7316. 31.5315.2
          538 41.3314. 51.2314. 61.0314. 70.9313. 80.7314. 90.6315.7
          538 100.4314.5110.2314.0120.1313.4129.9314.7139.8315.0149.6314.2
          538 159.4315.1169.3315.7179.1316.1189.0316.4198.8316.6208.7317.1
          538 215.2317.4228.3318.0238.2318.4248.0319.1264.1320.4265.7320.7
          538 273.3321.4334.6325.5
NS        538       1        1       1     5.4     7.8     8.9
NS        538     8.9      8.9       9     8.9     9.1     8.7
NS        538     7.6      7.2    6.25     6.6    6.95     5.5
NS        538     4.3      4.1     3.7     3.8     3.8       4
NS        538       4      3.6    3.35    3.55     2.5     2.5
NS        538     1.7      1.7
CAL1      538  318.85   719.07
CAL2      538  320.71  3490.03
VEL2      538                     0.88    1.28    1.77    1.59    1.86     2.5    2.36    2.02    2.59    2.61
VEL2      538    1.86     2.36    2.34    2.61    2.68     2.4    2.85    2.75    2.63    2.51    2.43    2.06
VEL2      538    2.43      2.2    1.72    1.47     0.3
CAL3      538  323.74     9814
XSEC    707.3 169.40.5   316.2       0
        707.3 0.0326.3 16.4320. 16.7319. 26.9318. 29.2318. 34.4318.5
        707.3 49.2317. 65.6316. 82.0315. 98.4315.7114.8317.7131.2317.0
        707.3 147.6316.7164.0317.2180.4317.2196.9317.0213.3317.6229.7317.3
        707.3 246.1317.8262.5317.9278.9318.0295.3318.1311.7317.8328.1318.0
        707.3 344.5317.8360.9318.1377.3318.8382.2319.3410.1320.9412.7320.9
        707.3 419.3321.4420.9321.0434.4322.6470.8327.1
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
NS       707.3     3.7      3.7       3      1.5      2.1      1.5
NS       707.3     1.9      1.9     1.9      2.1      2.4      3.5
NS       707.3     3.8      4.5     3.6      3.6      3.6      4.7
NS       707.3     3.9      3.6     4.8      4.8      3.9      3.9
NS       707.3     4.4      4.4     4.8      4.9        3        3
NS       707.3       3      4.7     2.1      2.1
CAL1     707.3  318.98   719.07
CAL2     707.3  320.94  3490.03
VEL2     707.3                      0.1     0.95     0.89     0.72     1.53     1.32     1.67     1.48      1.5     1.57
VEL2     707.3    2.11     2.53    2.89      3.1     3.22     2.74     3.75     3.57     3.87     3.97     4.23     4.51
VEL2     707.3     4.3     3.87    3.08     2.81
CAL3     707.3  324.25     9814
XSEC     753.8 46.50.00   317.4       0
         753.8 0.0325.8  3.3323.8  4.6322.6  21.0321.  22.6319.  28.5319.5
         753.8 47.6319.  72.5318.  82.0318.  91.9317.7101.7318.4118.1319.0
         753.8 151.9319.5176.8319.5211.0319.6226.4318.9242.8318.3259.2318.4
         753.8 275.6318.4292.0318.3308.4318.3324.8318.3341.2318.1354.3317.9
         753.8 367.5317.9380.6317.9393.7317.7406.8317.4419.9317.7433.1318.2
         753.8 446.2318.6459.3319.4460.6319.7469.2321.0524.6329.7
NS       753.8       1        1       1        1        1      2.5
NS       753.8     2.5      2.5     1.7      2.4      3.5      3.5
NS       753.8       3      3.2     4.4      4.1      3.8      3.8
NS       753.8     3.9        4     4.6      4.6      4.2      3.8
NS       753.8     4.6      4.6     4.6      4.6      4.6      3.9
NS       753.8     4.4      4.4     4.4      3.9      3.9
CAL1     753.8  319.15   719.07
CAL2     753.8  321.01  3490.03
VEL2     753.8                                       0.23     1.77     1.57     1.57     1.41     0.72     0.48     1.25
VEL2     753.8    2.23     3.22    3.54     3.94     3.69     4.35     4.23     4.15     4.18     4.02     3.75     4.48
VEL2     753.8     3.7     3.73    4.13     3.76     3.67     3.57     3.26     2.05     1.51
CAL3     753.8  324.27     9814
ENDJ
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t4 reach 3
MEDLOW              2/4/93          SUBSTRATUM2
IOC          1100100000000010000000
QARD         1926
QARD         3168
QARD         6771
XSEC             0 0.00.30          314.1           0
                 0 0.0319.3     3.3318.4     4.6316.6     5.2316.1     7.5315.5     16.4315.2
                 0 27.9315.5    42.7315.6    54.8315.5    78.7315.2105.0314.8131.2315.0
                 0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                 0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                 0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                 0 586.9316.1588.3318.5590.6319.3
NS               0          1          1          1          1        1.7        1.7
NS               0        4.6        4.6        3.4        3.9        3.4        3.4
NS               0        4.2        4.2        4.2        4.5        4.2        4.4
NS               0        4.9        4.9        4.8        4.8        4.3        4.8
NS               0        4.4        4.4        4.2        3.8        4.1        4.1
NS               0          1          1          1
CAL1             0     315.75      684.2
CAL2             0      316.6     3446.1
VEL2             0                                     1.48       0.83       1.39     1.48     1.71     1.57     1.95     1.85     2.44
VEL2             0       2.69       3.08       3.25    3.08       3.31       1.05     3.9      4.17     5.74     3.33     4.04     5.09
VEL2             0       5.64       5.15       5.31    4.36       2.89
CAL3             0     318.82      10374
XSEC         372.6 372.60.50        314.1           0
             372.6 0.0320.2     16.4318.4    23.0317.7    26.2317.2    32.8316.9    37.7316.0
             372.6 42.7313.6    52.5314.1    65.6314.1    82.0313.4    98.4313.4114.8313.7
             372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
             372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
             372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
             372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
NS           372.6       1.66        2.3        2.3        2.3       3.35        4.5
NS           372.6        5.3        6.9       6.25       6.25        6.2        6.5
NS           372.6        6.5        7.3        6.5        6.6       6.25        6.3
NS           372.6       5.85        5.9        6.1       6.55        7.7       5.25
NS           372.6        4.8       4.42        4.9        4.4        3.6        3.3
NS           372.6        3.5        3.5          1          1          1
CAL1         372.6     316.21      684.2
CAL2         372.6     317.68     3446.1
VEL2         372.6                                     1.02       1.18       1.84     2.55     2.88     2.64     2.59     2.71     2.53
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
VEL2    372.6       2.47      2.42       2.5      2.38       2.6      2.56    2.7   2.74   2.51   2.64   2.47   2.47
VEL2    372.6       2.63       2.4      2.32      2.12      1.66      1.25   1.02
CAL3    372.6     319.86     10374
XSEC    625.1 252.50.50      314.1         0
        625.1 0.0320.1    6.6317.8   8.2316.8    13.5316.2   26.2314.8   39.4313.9
        625.1 52.5313.2   65.6313.2  78.7312.4   91.9313.2105.0313.9118.1313.9
        625.1 131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4
        625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4
        625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS      625.1          1         1       4.5       4.8       4.8       4.8
NS      625.1        5.5       5.5       4.6       4.6       4.6       4.6
NS      625.1        4.6       4.2       4.2       3.7       4.4       3.7
NS      625.1        3.7       3.4       3.4       3.4       3.5       3.3
NS      625.1        3.3         1         1         1
CAL1    625.1     316.31     684.2
CAL2    625.1     317.82    3446.1
VEL2    625.1                           0.39      1.42      1.94      2.44   2.01    2.6   2.79   2.78   2.84   2.65
VEL2    625.1        2.8      2.51      2.72       2.6      2.86      2.83   2.62   2.32    2.5   1.72   1.68    1.1
CAL3    625.1     320.16     10374
XSEC    952.2 327.20.50      314.1         0
        952.2 0.0321.1    2.3318.0   16.4319.3   22.6318.0   26.2316.9   32.8316.3
        952.2 49.2314.4   65.6313.1  82.0313.5   98.4313.0114.8313.4131.2313.4
        952.2 147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7
        952.2 246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6
        952.2 344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7
        952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS      952.2                  1.8       4.4       4.4       4.8       5.6
NS      952.2        5.3       5.7      6.35         7       7.6       7.6
NS      952.2          8       8.5       6.4      6.45       6.3       5.5
NS      952.2        4.5       3.8       4.2       4.1       3.9       3.4
NS      952.2        3.2       3.1      2.96      2.97      2.65         1
NS      952.2          1         1         1         1
CAL1    952.2     316.47     684.2
CAL2    952.2     318.04    3446.1
VEL2    952.2                                               1.13      1.46    1.9   2.11   2.38    2.5   2.68    2.8
VEL2    952.2       2.79       2.6      3.04      2.67      2.61      2.52   2.47   1.95   1.85   1.95   2.01   1.91
VEL2    952.2       1.82      1.72      1.56      1.49      0.99         0
CAL3    952.2     320.61     10374
ENDJ
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t6 reach 4
velocity   calibration2
IOC          10001000000010000000
QARD         1554
QARD         2437
QARD         4648
XSEC            0 0.00.50      318.3          0
                0 0.0329.2    9.0329.2  9.1325.7  13.1324.4  18.0322.6  23.3321.1
                0 29.5320.1   39.4320.3 49.2320.1 59.1320.2  68.9320.0  78.7319.6
                0 88.6319.5   98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS              0         1         1      0.05         1         1         1       4.5
NS              0       4.6       4.7       4.9       5.4       5.6       5.7
NS              0       5.7       5.5       5.7       5.6       5.3       5.4
NS              0       5.2       5.5       5.7         5         5         5
NS              0       4.9       3.9         4         4       4.6       4.5
NS              0       4.5         4       4.2         4         4
WSL             0
CAL1            0    320.96    671.54
CAL2            0    322.57    2497.6
VEL2            0                                                    4.43      4.87      4.92      5.13      5.07      5.79      5.36
VEL2            0      5.04      5.61      6.19      5.49      4.99      5.24      6.23      5.94      5.82      5.05      5.36      4.89
VEL2            0      4.83      3.51      3.22
CAL3            0    325.16    6859.5
XSEC         85.5 85.50.50     318.3          0
             85.5 0.0329.6    5.6329.7  6.6326.0  12.5323.0  19.7320.8  23.0321.1
             85.5 28.9321.5   36.1318.4 42.7318.1 49.2316.7  55.8315.8  62.3314.8
             85.5 68.9314.4   75.5315.1 80.4315.4 85.3315.4  90.2315.4  95.1315.8
             85.5 5101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
             85.5 5144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
             85.5 5275.6323.1334.0325.4
NS           85.5         1         1       3.8       3.8      2.85      2.85
NS           85.5         3         4       4.3       5.3       6.2       6.4
NS           85.5       6.7       6.1       6.1       5.8       5.3       4.9
NS           85.5       5.2       5.4       5.2       4.8       4.6       4.6
NS           85.5      4.35       4.4       4.4      4.05       4.1       4.1
NS           85.5       2.8       2.8
WSL          85.5
CAL1         85.5    321.12    671.54
CAL2         85.5    322.97    2497.6
VEL2         85.5                                          0.72      0.46      0.36      1.73      2.14      2.73       3.8      4.84
VEL2         85.5       5.5      5.19      5.06       4.8       4.7      4.83      4.83       4.7      4.66      3.91      2.47       2.8
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

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```
VEL2          85.5      1.67      1.33
CAL3          85.5    325.38    6859.5
XSEC         177.9 92.40.30      318.3          0
             177.9 0.0329.2   11.8328.0  12.5326.4  19.7324.4  26.2323.2  29.5321.2
             177.9 32.8319.2  36.1316.6  39.4314.1  42.7312.4  45.9313.4  49.2312.6
             177.9 52.5312.8  55.8313.1  59.1313.1  62.3313.1  65.6313.1  68.9313.2
             177.9 75.5313.8  82.0316.8  88.6318.7  95.1319.8101.7320.0111.5320.6
             177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
             177.9 317.3325.2
NS           177.9      4.55      4.55      4.55       6.2       6.2       5.9
NS           177.9       5.9       5.9       5.9       6.1       6.3       6.3
NS           177.9         6       6.5      5.85      5.85      5.55      5.55
NS           177.9       5.4       4.8       4.8       4.6      4.45       4.8
NS           177.9      4.55      4.55      4.55      4.32      4.65       1.8
NS           177.9       1.8
WSL          177.9
CAL1         177.9    321.14    671.54
CAL2         177.9    323.25    2497.6
VEL2         177.9                                                        0.34      1.49       4.6      5.43      5.13      5.64      5.74
VEL2         177.9      5.87      5.77      5.53      5.41      5.19      5.21      4.66       4.1      3.83      3.44      3.37      2.88
VEL2         177.9      1.74      0.73
CAL3         177.9    325.46    6859.5
XSEC           454 276.20.50     318.3          0
               454 0.0330.1   2.5330.0   2.6323.5   6.6321.7   9.0319.6   13.1317.6
               454 16.4317.6  19.7316.5  23.0316.0  26.2316.2  29.5316.2  32.8316.7
               454 36.1317.1  39.4318.0  42.7318.6  45.9319.0  49.2319.1  54.5319.4
               454 59.1320.1  65.6320.3  70.2320.3  78.7320.8  85.3320.6  91.9321.1
               454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321 2150.9321.9
               454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
               454 345.1325.7360.9326.6
NS             454         1         1         1       1.5       3.7         6
NS             454       6.1       5.8         7       7.4       6.5         7
NS             454       6.1         5       4.8       4.7       5.4       5.5
NS             454       4.7       5.2       5.2       4.7       4.7       4.8
NS             454       4.8       4.9      4.75      4.75      4.65      4.95
NS             454       4.9         5         5       4.8       1.4         1
NS             454         1         1
WSL            454
CAL1           454    321.27    671.54
CAL2           454    323.55    2497.6
VEL2           454                                   0      1.35       4.6      4.65       5.1       5.4      5.52      5.27      5.27
VEL2           454      5.12      4.67      5.02      5.06      4.92      4.88      4.98      5.01      4.96      4.55      4.42      4.04
VEL2           454      4.41      4.05      4.31         4      4.69         0         0         0
CAL3           454    326.02    6859.5
```

TABLE VII-2

FILES FOR MEDIUM-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1MDCAL.IFG, R2MDCAL.IFG, R3MDCAL.IFG, AND R4MDCAL.IFG, RESPECTIVELY

(Page 11 of 11)

```
XSEC        732 277.90.50      319.1        0
            732 0.0327.4    3.6327.7    3.7324.8    4.9324.6    6.2324.0    8.2322.2
            732 10.2321.4   13.1320.1   19.7319.1   26.2319.5   32.8319.8   39.4320.1
            732 45.9319.8   52.5319.9   59.1320.3   65.6320.1   72.2320.3   78.7320.1
            732 85.3320.3   91.9320.1   98.4320.3108.3320.3118.1320.3128.0320.5
            732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
            732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS          732           1           1         1.4           1           1           1
NS          732         2.2           3         4.2         4.3         5.3         5.4
NS          732         5.4         4.8         5.1         5.4         5.2         5.7
NS          732         5.7         5.7         5.7         5.5         5.4         4.3
NS          732         4.2         4.4         4.4         4.4         3.9           4
NS          732         3.9         3.9         3.9           1           1           1
WSL         732
CAL1        732      321.91      671.54
CAL2        732      324.03      2497.6
VEL2        732                                                                     0      0.18      1.06      3.73      4.06      4.28      4.66
VEL2        732         4.5        5.07        4.62        4.74        4.72        5.06      4.78      4.43      4.68      4.77      4.31      4.39
VEL2        732        3.99        4.24        3.93        3.79        3.95        2.58      0.08
CAL3        732      326.43      6859.5
XSEC      923.4 191.40.00      319.1        0
          923.4 0.0328.3    12.6324.2   16.4322.1   22.0318.7   23.5317.1   36.1316.2
          923.4 42.7316.6   49.2317.4   55.8318.2   62.3318.7   68.9319.2   75.5319.3
          923.4 82.0319.5   88.6319.5   95.1319.6101.7319.9108.3320.0114.8320.4
          923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
          923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
          923.4 282.2325.2364.2326.5374.0326.6
NS        923.4         5.2         5.2        5.38        5.75         5.7         5.5
NS        923.4         5.8         5.6         5.4         5.4         4.5        4.55
NS        923.4        4.45        4.55         4.9         4.9           5         4.8
NS        923.4         4.8         4.4         4.3           4        4.85        4.85
NS        923.4         4.9         4.9         4.5         4.3         4.4         4.5
NS        923.4           1           1           1
WSL       923.4
CAL1      923.4      321.93      671.54
CAL2      923.4      324.24      2497.6
VEL2      923.4                              2.65        3.86        3.53        3.96      3.68      4.15      4.25      3.93      4.23      4.04
VEL2      923.4        3.77        3.88        3.77        3.81        3.93        3.24      2.94      2.96      2.58      2.78      2.51      2.23
VEL2      923.4        1.88        0.84
CAL3      923.4      326.54      6859.5
ENDJ
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

(Page 1 of 12)

```
HIGH flow Red Deer River t1 to t5 reach 1
SUBSTRATE          8/2/93          VADAS REMOVED TYPOS FOR T1, T2, & T5 NS)
IOC          11001001000010000000
QARD           9492
QARD          15000
QARD          20000
QARD          30000
XSEC              0 0.00.50            313.2      0.0006
                  0 0.0327.0   6.6324.5   15.4324.4  15.7323.8  18.0323.4  19.0323.5
                  0 19.7323.2  23.0321.6  39.4319.2  55.8316.5  72.2315.2  88.6313.2
                  0 105.0313.5118.1314.1131.2314.5144.4314.9157.5315.6170.6315.4
                  0 183.7315.6196.9316.1210.0317.0223.1318.0236.2319.5249.3318.2
                  0 260.8321.1269.0322.6273.3323.5275.6323.8279.2324.1348.1326.8
NS                0          1          1          1          1       1.85       1.57
NS                0       2.15          2          2          2          2          2
NS                0          2          2          2          2          2          2
NS                0          2          2       2.86        2.8       3.45       3.95
NS                0       3.37       2.57       1.83       1.83
WSL               0     325.94     327.36     328.32     329.78
CAL1              0     323.54     3906.3
VEL1              0
VEL1              0
VEL1              0
XSEC          203.2 203.20.50            318      0.0006
              203.2 0.0327.4   3.3326.0   3.5323.6   9.2322.0   18.0320.2  20.7319.5
              203.2 23.0319.3  25.6319.2  36.1319.2  54.5318.8  68.9319.2  82.0318.2
              203.2 95.1318.6108.3318.9121.4319.2134.5319.0154.2319.5173.9319.6
              203.2 193.6319.4213.3319.2226.4318.0239.5318.9252.6318.9265.7318.9
              203.2 278.9318.8292.0320.0311.7321.3331.4321.6341.9321.8360.9321.7
              203.2 377.3322.1388.8321.6397.0321.6405.2321.3410.4321.6419.0323.3
              203.2 419.9323.6433.7325.4459.3326.9
NS            203.2          1          1          1          2          2        2.2
NS            203.2        2.2        2.2          2          2          2          2
NS            203.2          2          2          2          2          2          2
NS            203.2          2          2          2          2        4.8          5
NS            203.2        5.8        5.8        5.9        5.9        6.3        6.1
NS            203.2        6.1        6.1        6.1        4.6          1        1.5
```

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
NS      203.2         1         1
WSL     203.2    326.21    328.06    329.48    331.87
CAL1    203.2    323.65    3906.3
VEL1    203.2
VEL1    203.2
VEL1    203.2
VEL1    203.2
XSEC    544.5 341.30.50         319      0.0005
        544.5 0.0329.5   3.0328.0   6.2322.6   10.5321.8  11.5321.5  14.8321.2
        544.5 17.1321.1  26.9323.9  49.2323.2  82.0323.0114.8322.9147.6322.7
        544.5 173.9322.6200.1321.1226.4319.8252.6319.8278.9320.0305.1319.8
        544.5 331.4319.8357.6319.8383.9319.7410.1319.3436.4319.0462.6319.3
        544.5 488.8319.3515.1320.0541.3320.3567.6320.5580.7320.3593.8320.8
        544.5 595.1320.8596.8321.3599.1322.5602.0323.9602.7325.8610.6326.2
        544.5 613.8327.6
NS      544.5         1         1         1         2         2         2
NS      544.5         2         2         2         2         2       2.6
NS      544.5       2.1         2         2         2         2         2
NS      544.5       2.2       2.2         2         2         2         2
NS      544.5         2         2         2         2         2         2
NS      544.5         2         2         2         2         1         1
NS      544.5         1
WSL     544.5    326.51    328.48    330.05    332.74
CAL1    544.5     323.9    3906.3
VEL1    544.5
VEL1    544.5
VEL1    544.5
VEL1    544.5
XSEC    717.5 173.00.50         319      0.0003
        717.5 0.0328.9    8.6324.7   42.7324.4  75.5324.2102.0324.0108.3323.9
        717.5 121.4323.6141.4323.4147.6323.3154.2323.0161.1322.9163.4322.8
        717.5 190.3322.3216.5321.9241.5321.7246.1321.5262.5321.6278.9321.6
        717.5 295.3321.4311.7321.3328.1320.7344.5319.9360.9319.4377.3319.2
        717.5 393.7319.1410.1318.1426.5317.9442.9317.6459.3316.4475.7315.8
        717.5 492.1315.5508.5318.1524.9321.4534.1322.0549.5323.0559.1324.0
        717.5 562.7326.5565.0326.0566.9326.5570.2326.6
NS      717.5         1         2         2         2         2         2
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

(Page 3 of 12)

```
NS          717.5       2       1.8       1.8       1.8       2       2
NS          717.5       2       2         2         2         2       2.2
NS          717.5       2.2     2.2       2.2       2.2       2.1     2.1
NS          717.5       2.1     2.1       2         2         2       2
NS          717.5       3       3.8       4.1       5.1       1       1
NS          717.5       1       1         1         1
WSL         717.5     326.57    328.54    330.1     332.78
CAL1        717.5     323.98    3906.3
VEL1        717.5
VEL1        717.5
VEL1        717.5
VEL1        717.5
XSEC          981 263.50.50          319      0.0002
              981 0.0328.6     5.6326.2    6.6324.1     36.1322.8    59.1322.8    78.7322.8
              981 96.8322.8121.4322.5141.1322.6160.8322.5183.7322.4203.4322.2
              981 216.5322.0242.8321.3265.7321.1285.4321.2300.2320.9305.4320.9
              981 318.2320.9331.4319.6344.5319.2357.6318.4370.7317.6383.9317.4
              981 397.0317.7410.1318.6423.2318.9436.4318.9449.5318.2462.6317.6
              981 475.7317.7488.8319.6502.0321.2515.4322.4524.9323.0537.4323.9
              981 540.5324.1545.6327.4548.9327.3
NS            981       1       1         1.7       1.8       1.8     1.6
NS            981       1.4     1.4       1.4       1.4       1.4     1.4
NS            981       1.5     1.4       1.6       1.4       1.3     1.3
NS            981       1.2     1.1       1.3       1.8       1.8     1.8
NS            981       2       2         2         2         2.95    3.4
NS            981       3.2     4         3.7       3.75      2.25    1
NS            981       1       1         1
WSL           981     326.67    328.62    330.17    332.84
CAL1          981     324.15    3906.3
VEL1          981
VEL1          981
VEL1          981
VEL1          981
ENDJ
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
HIGH flow Red Deer River t1 to t5 reach 2
SUBSTRATE            10/9/91
IOC           1100100000010000000
QARD            9814
QARD           15000
QARD           20000
QARD           30000
XSEC               0 0.00.50          316.2          0
                   0 0.0323.7     14.1320.5     14.4319.9     15.4319.4     23.5318.3     29.5317.8
                   0 39.4317.2    59.1316.2     78.7316.2     98.4316.6118.1317.2137.8317.4
                   0 157.5317.7177.2317.9196.9318.2216.5318.3236.2318.5255.9318.6
                   0 275.6318.6292.0318.4295.3318.4315.0318.1334.6317.6354.3316.9
                   0 374.0316.4387.1316.4400.3316.5413.4317.4419.9318.1424.5318.6
                   0 429.1319.9437.3320.7444.6322.5465.2326.2
NS                 0          1           3.7           3.7           4.2          2.75           3.7
NS                 0        4.4             5           3.6           3.6           3.4           3.4
NS                 0        3.1           3.1           3.1           3.5           3.5           2.9
NS                 0        2.9           2.9           2.9           2.9           3.1           3.5
NS                 0        3.7           4.6           5.3           3.8             3           4.6
NS                 0          3             1             1             1
CAL1               0      318.5        719.07
CAL2               0     319.85       3490.03
VEL2               0
VEL2               0
VEL2               0
CAL3               0     322.59          9814
XSEC           438.4 438.40.50          316.2          0
               438.4 0.0324.3     9.8322.8      20.3320.6     20.7320.6     26.2320.1     42.0318.5
               438.4 55.8317.9    68.9317.5     82.0314.9     95.1315.5108.3315.6121.4314.2
               438.4 134.5314.1147.6313.5160.8313.4173.9312.8187.0314.1200.1314.9
               438.4 213.3315.6226.4316.2239.5316.8252.6317.5265.7317.8278.9318.1
               438.4 292.7318.9304.5319.8306.4320.6308.7321.1378.0325.9
NS             438.4          1             1             1             1             1             6
NS             438.4        6.6           6.5           6.5           6.3           6.6          6.65
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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NS	438.4	7.3	7.2	6.4	6.55	4.7	4.3
NS	438.4	4.25	3.9	4.2	4	3.1	2.8
NS	438.4	3.1	2.9	2.9	1.3	1.3	
CAL1	438.4	318.83	719.07				
CAL2	438.4	320.63	3490.03				
VEL2	438.4						
VEL2	438.4						
VEL2	438.4						
CAL3	438.4	323.55	9814				
XSEC	538	99.60.60	316.2	0			
	538	0.0325.4	6.6323.0	13.1318.4	15.1318.2	21.7316.3	31.5315.2
	538	41.3314.7	51.2314.9	61.0314.2	70.9313.7	80.7314.2	90.6315.7
	538	100.4314.5110.2314.0120.1313.4129.9314.7139.8315.0149.6314.2					
	538	159.4315.1169.3315.7179.1316.1189.0316.4198.8316.6208.7317.1					
	538	215.2317.4228.3318.0238.2318.4248.0319.1264.1320.4265.7320.7					
	538	273.3321.4334.6325.5					
NS	538	1	1	1	5.4	7.8	8.9
NS	538	8.9	8.9	9	8.9	9.1	8.7
NS	538	7.6	7.2	6.25	6.6	6.95	5.5
NS	538	4.3	4.1	3.7	3.8	3.8	4
NS	538	4	3.6	3.35	3.55	2.5	2.5
NS	538	1.7	1.7				
CAL1	538	318.85	719.07				
CAL2	538	320.71	3490.03				
VEL2	538						
VEL2	538						
VEL2	538						
CAL3	538	323.74	9814				
XSEC	707.3	169.40.50	316.2	0			
	707.3	0.0326.3	16.4320.9	16.7319.0	26.9318.9	29.2318.8	34.4318.5
	707.3	49.2317.3	65.6316.4	82.0315.5	98.4315.7114.8317.7131.2317.0		
	707.3	147.6316.7164.0317.2180.4317.2196.9317.0213.3317.6229.7317.3					
	707.3	246.1317.8262.5317.9278.9318.0295.3318.1311.7317.8328.1318.0					
	707.3	344.5317.8360.9318.1377.3318.8382.2319.3410.1320.9412.7320.9					

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
             707.3 419.3321.4420.9321.0434.4322.6470.8327.1
NS           707.3      3.7      3.7        3      1.5      2.1      1.5
NS           707.3      1.9      1.9      1.9      2.1      2.4      3.5
NS           707.3      3.8      4.5      3.6      3.6      3.6      4.7
NS           707.3      3.9      3.6      4.8      4.8      3.9      3.9
NS           707.3      4.4      4.4      4.8      4.9        3        3
NS           707.3        3      4.7      2.1      2.1
CAL1         707.3   318.98   719.07
CAL2         707.3   320.94  3490.03
VEL2         707.3
VEL2         707.3
VEL2         707.3
CAL3         707.3   324.25     9814
XSEC         753.8 46.50.00    317.4        0
             753.8 0.0325.8  3.3323.8  4.6322.6  21.0321.0  22.6319.9  28.5319.5
             753.8 47.6319.2  72.5318.8  82.0318.1  91.9317.7101.7318.4118.1319.0
             753.8 151.9319.5176.8319.5211.0319.6226.4318.9242.8318.3259.2318.4
             753.8 275.6318.4292.0318.3308.4318.3324.8318.3341.2318.1354.3317.9
             753.8 367.5317.9380.6317.9393.7317.7406.8317.4419.9317.7433.1318.2
             753.8 446.2318.6459.3319.4460.6319.7469.2321.0524.6329.7
NS           753.8        1        1        1        1        1      2.5
NS           753.8      2.5      2.5      1.7      2.4      3.5      3.5
NS           753.8        3      3.2      4.4      4.1      3.8      3.8
NS           753.8      3.9        4      4.6      4.6      4.2      3.8
NS           753.8      4.6      4.6      4.6      4.6      4.6      3.9
NS           753.8      4.4      4.4      4.4      3.9      3.9
CAL1         753.8   319.15   719.07
CAL2         753.8   321.01  3490.03
VEL2         753.8
VEL2         753.8
VEL2         753.8
CAL3         753.8   324.27     9814
ENDJ
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
high flow Red Deer River t1 to t4 reach 3
HIFLOW              4-Feb       1993
IOC          11101001000010000000
QARD         10374
QARD         15000
QARD         20000
QARD         30000
XSEC             0 0.00.30          314.1             0
                 0 0.0319.3    3.3318.4    4.6316.6    5.2316.1    7.5315.5    16.4315.2
                 0 27.9315.5   42.7315.6   54.8315.5   78.7315.2105.0314.8131.2315.0
                 0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                 0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                 0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                 0 586.9316.1588.3318.5590.6319.3
NS               0          1           1           1           1         1.7         1.7
NS               0        4.6         4.6         3.4         3.9         3.4         3.4
NS               0        4.2         4.2         4.2         4.5         4.2         4.4
NS               0        4.9         4.9         4.8         4.8         4.3         4.8
NS               0        4.4         4.4         4.2         3.8         4.1         4.1
NS               0          1           1           1
WSL              0     318.82      320.06      321.28      319.25
CAL1             0      316.6      3446.1
VEL1             0
VEL1             0
VEL1             0
XSEC         372.6 372.60.50        314.1             0
             372.6 0.0320.2    16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.0
             372.6 42.7313.6   52.5314.1   65.6314.1   82.0313.4   98.4313.4114.8313.7
             372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
             372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
             372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
             372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
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TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

(Page 8 of 12)

```
NS         372.6      1.66      2.3      2.3      2.3     3.35      4.5
NS         372.6       5.3      6.9     6.25     6.25      6.2      6.5
NS         372.6       6.5      7.3      6.5      6.6     6.25      6.3
NS         372.6      5.85      5.9      6.1     6.55      7.7     5.25
NS         372.6       4.8     4.42      4.9      4.4      3.6      3.3
NS         372.6       3.5      3.5        1        1        1
WSL        372.6    319.86   320.89   321.98   322.51
CAL1       372.6    317.68   3446.1
VEL1       372.6
VEL1       372.6
VEL1       372.6
XSEC       625.1 252.50.50      314.1        0
           625.1 0.0320.1     6.6317.8   8.2316.8   13.5316.2   26.2314.8   39.4313.9
           625.1 52.5313.2    65.6313.2  78.7312.4  91.9313.2105.0313.9118.1313.9
           625.1 131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4
           625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4
           625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS         625.1         1        1      4.5      4.8      4.8      4.8
NS         625.1       5.5      5.5      4.6      4.6      4.6      4.6
NS         625.1       4.6      4.2      4.2      3.7      4.4      3.7
NS         625.1       3.7      3.4      3.4      3.4      3.5      3.3
NS         625.1       3.3        1        1        1
WSL        625.1    320.16   321.19   322.28   323.03
CAL1       625.1    317.82   3446.1
VEL1       625.1
VEL1       625.1
VEL1       625.1
XSEC       952.2 327.20.50      314.1        0
           952.2 0.0321.1     2.3318.0   16.4319.3   22.6318.0   26.2316.9   32.8316.3
           952.2 49.2314.4    65.6313.1  82.0313.5   98.4313.0114.8313.4131.2313.4
           952.2 147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7
           952.2 246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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	952.2	344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7					
	952.2	398.6318.0405.8319.5412.7318.0416.7322.1					
NS	952.2	1	1.8	4.4	4.4	4.8	5.6
NS	952.2	5.3	5.7	6.35	7	7.6	7.6
NS	952.2	8	8.5	6.4	6.45	6.3	5.5
NS	952.2	4.5	3.8	4.2	4.1	3.9	3.4
NS	952.2	3.2	3.1	2.96	2.97	2.65	1
NS	952.2	1	1	1	1		
WSL	952.2	320.61	321.65	322.74	323.73		
CAL1	952.2	318.04	3446.1				
VEL1	952.2						
VEL1	952.2						
VEL1	952.2						
ENDJ							

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
high flow Red Deer River t1 to t4 reach 4
HI        FLOW       A              FEB 4 1993
IOC             110010010000100000000
QARD            6859
QARD           10000
QARD           15000
QARD           20000
XSEC                0 0.00.50           318.3           0
                    0 0.0329.2     9.0329.2     9.1325.7     13.1324.4    18.0322.6    23.3321.1
                    0 29.5320.1    39.4320.3    49.2320.1    59.1320.2    68.9320.0    78.7319.6
                    0 88.6319.5    98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                    0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                    0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                    0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                  0           1           1        0.05           1           1           1      4.5
NS                  0         4.6         4.7         4.9         5.4         5.6         5.7
NS                  0         5.7         5.5         5.7         5.6         5.3         5.4
NS                  0         5.2         5.5         5.7           5           5           5
NS                  0         4.9         3.9           4           4         4.6         4.5
NS                  0         4.5           4         4.2           4           4
WSL                 0      325.16      326.41      328.11      329.64
CAL1                0      322.57     2497.56
VEL1                0
VEL1                0
VEL1                0
XSEC             85.5 85.50.50          318.3           0
                 85.5 0.0329.6     5.6329.7     6.6326.0     12.5323.0    19.7320.8    23.0321.1
                 85.5 28.9321.5    36.1318.4    42.7318.1    49.2316.7    55.8315.8    62.3314.8
                 85.5 68.9314.4    75.5315.1    80.4315.4    85.3315.4    90.2315.4    95.1315.8
                 85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
                 85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
                 85.5 275.6323.1334.0325.4
NS               85.5           1           1         3.8         3.8        2.85        2.85
NS               85.5           3           4         4.3         5.3         6.2         6.4
NS               85.5         6.7         6.1         6.1         5.8         5.3         4.9
NS               85.5         5.2         5.4         5.2         4.8         4.6         4.6
NS               85.5        4.35         4.4         4.4        4.05         4.1         4.1
NS               85.5         2.8         2.8
WSL              85.5       325.4      326.59      328.26      329.76
CAL1             85.5      322.97     2497.56
VEL1             85.5
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
VEL1     85.5
VEL1     85.5
XSEC     177.9 92.40.30        318.3         0
         177.9 0.0329.2    11.8328.0   12.5326.4   19.7324.4   26.2323.2   29.5321.2
         177.9 32.8319.2   36.1316.6   39.4314.1   42.7312.4   45.9313.4   49.2312.6
         177.9 52.5312.8   55.8313.1   59.1313.1   62.3313.1   65.6313.1   68.9313.2
         177.9 75.5313.8   82.0316.8   88.6318.7   95.1319.8101.7320.0111.5320.6
         177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
         177.9 317.3325.2
NS       177.9       4.55        4.55        4.55         6.2         6.2         5.9
NS       177.9        5.9         5.9         5.9         6.1         6.3         6.3
NS       177.9          6         6.5        5.85        5.85        5.55        5.55
NS       177.9        5.4         4.8         4.8         4.6        4.45         4.8
NS       177.9       4.55        4.55        4.55        4.32        4.65         1.8
NS       177.9        1.8
WSL      177.9     325.53      326.72      328.37      329.86
CAL1     177.9     323.25     2497.56
VEL1     177.9
VEL1     177.9
VEL1     177.9
XSEC       454 276.20.50       318.3         0
           454 0.0330.1    2.5330.0    2.6323.5    6.6321.7    9.0319.6    13.1317.6
           454 16.4317.6   19.7316.5   23.0316.0   26.2316.2   29.5316.2   32.8316.7
           454 36.1317.1   39.4318.0   42.7318.6   45.9319.0   49.2319.1   54.5319.4
           454 59.1320.1   65.6320.3   70.2320.3   78.7320.8   85.3320.6   91.9321.1
           454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
           454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
           454 345.1325.7360.9326.6
NS         454          1        0.14           1           1         1.5         3.7      6
NS         454        6.1         5.8           7         7.4         6.5           7
NS         454        6.1           5         4.8         4.7         5.4         5.5
NS         454        4.7         5.2         5.2         4.7         4.7         4.8
NS         454        4.8         4.9        4.75        4.75        4.65        4.95
NS         454        4.9           5           5         4.8         1.4           1
NS         454          1           1
WSL        454     326.09      327.34      329.02      330.51
CAL1       454     323.55     2497.56
VEL1       454
VEL1       454
VEL1       454
VEL1       454
```

TABLE VII-3

FILES FOR HIGH-FLOW SIMULATION WITH SUBSTRATUM DATA WERE R1HICAL.IFG, R2HICAL.IFG, R3HICAL.IFG, AND R4HICAL.IFG, RESPECTIVELY

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```
XSEC    732 277.90.50        319.1         0
        732 0.0327.4    3.6327.7    3.7324.8    4.9324.6    6.2324.0    8.2322.2
        732 10.2321.4   13.1320.1   19.7319.1   26.2319.5   32.8319.8   39.4320.1
        732 45.9319.8   52.5319.9   59.1320.3   65.6320.1   72.2320.3   78.7320.1
        732 85.3320.3   91.9320.1   98.4320.3108.3320.3118.1320.3128.0320.5
        732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
        732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS      732          1          1        1.4          1          1          1
NS      732       0.06        2.2       0.06          3        4.2        4.3        5.3        5.4
NS      732        5.4        4.8        5.1        5.4        5.2        5.7
NS      732        5.7        5.7        5.7        5.5        5.4        4.3
NS      732        4.2        4.4        4.4        4.4        3.9          4
NS      732        3.9        3.9        3.9          1          1          1
WSL     732     326.43     327.62     329.19     330.53
CAL1    732     324.04    2497.56
VEL1    732
VEL1    732
VEL1    732
XSEC    923.4 191.40.00      319.1         0
        923.4 0.0328.3    12.8324.2   16.4322.1   22.0318.7   23.5317.1   36.1316.2
        923.4 42.7316.6   49.2317.4   55.8318.2   62.3318.7   68.9319.2   75.5319.3
        923.4 82.0319.5   88.6319.5   95.1319.6101.7319.9108.3320.0114.8320.4
        923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
        923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
        923.4 282.2325.2364.2326.5374.0326.6
NS      923.4        5.2        5.2       5.38       5.75        5.7        5.5
NS      923.4        5.8        5.6        5.4        5.4        4.5       4.55
NS      923.4       4.45       4.55        4.9        4.9          5        4.8
NS      923.4        4.8        4.4        4.3          4       4.85       4.85
NS      923.4        4.9        4.9        4.5        4.3        4.4        4.5
NS      923.4          1          1          1
WSL     923.4     326.54     327.71     329.26     330.59
CAL1    923.4     324.24    2497.56
VEL1    923.4
VEL1    923.4
VEL1    923.4
ENDJ
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

(Page 1 of 7)

```
RDRIFIM t1 to t4 reach 3
JUVENIL LOW        FLOW        23/01/93
IOC          11001001000010000000
QARD          150
QARD          300
QARD          450
QARD        684.2
XSEC             0 0.00.50         314.4      0.0024
                 0 0.0319.3   3.3318.4   4.6316.6   5.2317.0   7.5315.8   16.4315.8
                 0 27.9315.8  42.7316.3  54.8315.8  78.7315.5105.0315.1131.2315.1
                 0 157.5315.4183.7315.5210.0315.5236.2315.3262.5315.3288.7315.0
                 0 315.0314.9341.2314.6367.5314.6393.7314.6419.9314.5446.2314.4
                 0 472.4314.7498.7314.8524.9314.5551.2314.5579.1315.8585.6315.8
                 0 586.9316.1588.3318.5590.6319.3
NS               0       2.5       2.5       2.5       2.5         1         1
NS               0       2.5       2.5       2.5       2.5       2.5       2.5
NS               0       2.5       2.5       2.5       2.5       2.5       2.5
NS               0       2.5       2.5       2.5       2.5       2.5       2.5
NS               0       2.5       2.5       2.5       2.5       2.5       2.5
NS               0       2.5       2.5       2.5
WSL              0    315.25    315.46     315.6    315.75
CAL1             0    315.75    684.23
VEL1             0                                                                                         0.87      1.15      1.13
VEL1             0      0.99      0.27      0.51      0.89      0.64      2.02      2.11      2.41      2.24      2.89      2.21      3.05
VEL1             0      2.66      2.58      2.21      1.57
CAL2             0     316.6      3168
VEL2             0
VEL2             0
VEL2             0
CAL3             0    318.82     10374
VEL3             0
VEL3             0
VEL3             0
XSEC         372.6 372.60.50         314.4     0.00301
             372.6 0.0320.2   16.4318.4  23.0317.7  26.2317.2  32.8316.9  37.7316.3
             372.6 42.7314.2  52.5313.8  65.6314.0  82.0313.3  98.4313.6114.8313.2
             372.6 131.2313.3147.6312.2164.0313.0180.4313.9196.9313.2213.3313.5
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

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```
         372.6 229.7314.1246.1314.0262.5314.4278.9313.8295.3313.8311.7313.4
         372.6 328.1314.3344.5314.5360.9314.7377.3315.0393.7315.1410.1316.2
         372.6 413.4316.3418.0317.7419.9317.3420.6318.9422.6320.9
NS       372.6        2        1        1        1        2        1
NS       372.6        2        2        2        2        2        2
NS       372.6        2        2        2        2        2        2
NS       372.6        2        2        2        1        2        1
NS       372.6        1        1        1        1        1        1
NS       372.6        3        3      2.5      2.5      2.5
WSL      372.6   315.38   315.68    315.9   316.16
CAL1     372.6   316.26   684.23
VEL1     372.6                                                      0.96     0.88     0.81     0.82     0.85     0.85
VEL1     372.6     0.93     0.76     0.86     1.18     0.89     0.83     0.74     0.78     0.82     0.65     0.62     0.62
VEL1     372.6     0.69     0.69     0.61     0.54     0.51     0.18        0
CAL2     372.6   317.68   3168.8
VEL2     372.6
VEL2     372.6
VEL2     372.6
CAL3     372.6   319.86    10374
VEL3     372.6
VEL3     372.6
VEL3     372.6
XSEC     625.1 252.50.50         314.4      0.0015
         625.1 0.0320.1    6.6317.9    8.2317.2    13.5316.3   26.2314.8   39.4314.0
         625.1 52.5313.5   65.6313.2   78.7312.5   91.9313.0105.0313.5118.1313.6
         625.1 131.2314.0157.5313.7183.7314.0210.0314.1236.2313.9262.5314.4
         625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.3
         625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS       625.1      2.5      2.5      2.5      2.5      2.5      2.5
NS       625.1      2.5      2.5      2.5      2.5      2.5      2.5
NS       625.1      2.5      2.5      2.5      2.5      2.5      2.5
NS       625.1      2.5      2.5      2.5      2.5      2.5      2.5
NS       625.1      2.5      2.5      2.5      2.5
WSL      625.1   315.43   315.77   316.01   316.31
CAL1     625.1   316.31   684.23
VEL1     625.1                                0.71     0.73      0.8        1     0.99        1     0.96     0.78
VEL1     625.1     0.94     0.88     0.87     0.94     1.06     1.02     0.96     0.71     0.56     0.41     0.31
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

(Page 3 of 7)

```
VEL1      625.1
CAL2      625.1     317.82     3168.8
VEL2      625.1
VEL2      625.1
VEL2      625.1
CAL3      625.1     320.16      10374
VEL3      625.1
VEL3      625.1
VEL3      625.1
XSEC      952.2 327.20.50       314.4     0.00053
          952.2 0.0321.1     2.3318.0    16.4319.3    22.6316.2    26.2317.0    32.8316.5
          952.2 49.2314.4    65.6313.3   82.0313.2    98.4312.8114.8313.0131.2313.4
          952.2 147.6313.2164.0313.9180.4313.3196.9313.2213.3313.8229.7313.8
          952.2 246.1314.0262.5314.5278.9314.8295.3315.1311.7315.5328.1315.8
          952.2 344.5315.8360.9316.1377.3316.4388.1316.5393.7316.6397.0317.1
          952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS        952.2          1          2          2          2          2          2
NS        952.2          2          2          2          2          2          2
NS        952.2          2          2          1          1          1          1
NS        952.2          1          1          1          1          1          1
NS        952.2          1          1          1          1          1        2.5
NS        952.2        2.5        2.5        2.5        2.5
WSL       952.2     315.51     315.89     316.17     316.51
CAL1      952.2     316.46     684.23
VEL1      952.2                                                                  0.42       0.88       0.85       0.97       1.16        1.2
VEL1      952.2        1.1       1.21       1.03       1.09       1.07       0.88       0.62       0.65       0.58       0.55        0.5       0.42
VEL1      952.2       0.24       0.22       0.09
CAL2      952.2     318.04     3168.8
VEL2      952.2
VEL2      952.2
VEL2      952.2
CAL3      952.2      320.6      10374
VEL3      952.2
VEL3      952.2
VEL3      952.2
ENDJ
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t4 reach 3
JUVENIL        FEB 4          1993
IOC            11001000000010000000
QARD           1926
QARD           3168
QARD           6771
XSEC              0 0.00.30          314.1       0
                  0 0.0319.3     3.3318.4    4.6316.6    5.2316.1    7.5315.5    16.4315.2
                  0 27.9315.5    42.7315.6   54.8315.5   78.7315.2105.0314.8131.2315.0
                  0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                  0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                  0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                  0 586.9316.1588.3318.5590.6319.3
NS                0       2.5         2.5         2.5         2.5          1           1
NS                0       2.5         2.5         2.5         2.5         2.5         2.5
NS                0       2.5         2.5         2.5         2.5         2.5         2.5
NS                0       2.5         2.5         2.5         2.5         2.5         2.5
NS                0       2.5         2.5         2.5         2.5         2.5         2.5
NS                0       2.5         2.5         2.5         2.5         2.5         2.5
CAL1              0     315.75      684.2       2.5
CAL2              0     316.6      3446.1
VEL2              0
VEL2              0       2.69        3.08                    1.48        0.83        1.39     1.48     1.71     1.57     1.95     1.85     2.44
VEL2              0       5.64        5.15        3.25        3.08        3.31        1.05     3.9      4.17     5.74     3.33     4.04     5.09
CAL3              0     318.82      10374         5.31        4.36        2.89
XSEC          372.6 372.60.50        314.1       0
              372.6 0.0320.2     16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.0
              372.6 42.7313.6    52.5314.1   65.6314.1   82.0313.4   98.4313.4114.8313.7
              372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
              372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
              372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
              372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
NS            372.6       2           1           1           1           2           1
NS            372.6       2           2           2           2           2           2
NS            372.6       2           2           2           2           2           2
NS            372.6       2           2           2           2           2           2
NS            372.6       1           1           2           1           2           1
NS            372.6       3           3           1           1           1           1
CAL1          372.6     316.21      684.2       2.5         2.5         2.5
CAL2          372.6     317.68     3446.1
VEL2          372.6
                                                1.02        1.18        1.84     2.55     2.88     2.64     2.59     2.71     2.53
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

(Page 5 of 7)

```
VEL2   372.6     2.47     2.42     2.5      2.38     2.6      2.56   2.7    2.74   2.51   2.64   2.47   2.47
VEL2   372.6     2.63     2.4      2.32     2.12     1.66     1.25   1.02
CAL3   372.6   319.86    10374
XSEC   625.1 252.50.50     314.1            0
       625.1 0.0320.1   6.6317.8   8.2316.8   13.5316.2   26.2314.8   39.4313.9
       625.1 52.5313.2  65.6313.2  78.7312.4  91.9313.2105.0313.9118.1313.9
       625.1 131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4
       625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4
       625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS     625.1     2.5      2.5      2.5      2.5      2.5      2.5
NS     625.1     2.5      2.5      2.5      2.5      2.5      2.5
NS     625.1     2.5      2.5      2.5      2.5      2.5      2.5
NS     625.1     2.5      2.5      2.5      2.5      2.5      2.5
NS     625.1     2.5      2.5      2.5      2.5
CAL1   625.1   316.31    684.2
CAL2   625.1   317.82   3446.1
VEL2   625.1                      0.39     1.42     1.94     2.44   2.01   2.8    2.79   2.78   2.84   2.65
VEL2   625.1     2.8      2.51     2.72     2.6      2.86     2.83   2.62   2.32   2.5    1.72   1.68   1.1
VEL2   625.1
CAL3   625.1   320.16    10374
XSEC   952.2 327.20.50     314.1            0
       952.2 0.0321.1   2.3318.0  16.4319.3   22.6318.0   26.2316.9   32.8316.3
       952.2 49.2314.4  65.6313.1  82.0313.5  98.4313.0114.8313.4131.2313.4
       952.2 147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7
       952.2 246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6
       952.2 344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7
       952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS     952.2     1        2        2        2        2        2
NS     952.2     2        2        2        2        2        2
NS     952.2     2        2        1        1        1        1
NS     952.2     1        1        1        1        1        1
NS     952.2     1        1        1        1        1        2.5
NS     952.2     2.5      2.5      2.5      2.5
CAL1   952.2   316.47    684.2
CAL2   952.2   318.04   3446.1
VEL2   952.2                                        1.13     1.46   1.9    2.11   2.38   2.5    2.68   2.8
VEL2   952.2     2.79     2.6      3.04     2.67     2.61     2.52   2.47   1.95   1.85   1.95   2.01   1.91
VEL2   952.2     1.82     1.72     1.56     1.49     0.99     0
CAL3   952.2   320.61    10374
ENDJ
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

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```
HIGH flow Red Deer River t1 to t4 reach 3
JUVENIL        FEB 4        1993
IOC           1100100100001000000
QARD          10374
QARD          15000
QARD          20000
QARD          30000
XSEC              0 0.00.30          314.1        0
                  0 0.0319.3    3.3318.4    4.6316.6    5.2316.1    7.5315.5    16.4315.2
                  0 27.9315.5   42.7315.6   54.8315.5   78.7315.2105.0314.8131.2315.0
                  0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                  0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                  0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                  0 586.9316.1588.3318.5590.6319.3
NS                0        2.5         2.5         2.5         2.5         1           1
NS                0        2.5         2.5         2.5         2.5         2.5         2.5
NS                0        2.5         2.5         2.5         2.5         2.5         2.5
NS                0        2.5         2.5         2.5         2.5         2.5         2.5
NS                0        2.5         2.5         2.5         2.5         2.5         2.5
NS                0        2.5         2.5         2.5
WSL               0        318.82      320.06      321.28      319.25
CAL1              0        316.6       3446.1
VEL1              0
VEL1              0
VEL1              0
XSEC          372.6 372.60.50        314.1        0
              372.6 0.0320.2    16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.0
              372.6 42.7313.6   52.5314.1   65.6314.1   82.0313.4   98.4313.4114.8313.7
              372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
              372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
              372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
              372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
NS            372.6        2           1           1           1           2           1
NS            372.6        2           2           2           2           2           2
NS            372.6        2           2           2           2           2           2
NS            372.6        2           2           2           1           2           1
NS            372.6        1           1           1           1           1           1
NS            372.6        3           3           2.5         2.5         2.5
WSL           372.6        319.86      320.89      321.98      322.51
CAL1          372.6        317.68      3446.1
```

TABLE VII-4

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 3 WERE R3LOJUV.IFG, R3MDJUV.IFG, AND R3HIJUV.IFG, RESPECTIVELY

(Page 7 of 7)

```
VEL1        372.6
VEL1        372.6
VEL1        372.6
XSEC        625.1 252.50.50        314.1          0
            625.1 0.0320.1     6.6317.8    8.2316.8    13.5316.2   26.2314.8   39.4313.9
            625.1 52.5313.2    65.6313.2   78.7312.4   91.9313.2105.0313.9118.1313.9
            625.1 131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4
            625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4
            625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS          625.1          2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1          2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1          2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1          2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1          2.5         2.5         2.5         2.5
WSL         625.1       320.16      321.19      322.28      323.03
CAL1        625.1       317.82      3446.1
VEL1        625.1
VEL1        625.1
VEL1        625.1
XSEC        952.2 327.20.50        314.1          0
            952.2 0.0321.1     2.3318.0    16.4319.3   22.6318.0   26.2316.9   32.8316.3
            952.2 49.2314.4    65.6313.1   82.0313.5   98.4313.0114.8313.4131.2313.4
            952.2 147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7
            952.2 246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6
            952.2 344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7
            952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS          952.2            1           2           2           2           2           2
NS          952.2            2           2           2           2           2           2
NS          952.2            2           2           1           1           1           1
NS          952.2            1           1           1           1           1           1
NS          952.2            1           1           1           1           1         2.5
NS          952.2          2.5         2.5         2.5         2.5
WSL         952.2       320.61      321.65      322.74      323.73
CAL1        952.2       318.04      3446.1
VEL1        952.2
VEL1        952.2
VEL1        952.2
ENDJ
```

TABLE VII-5

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

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```
RDRIFIM t1 to t4 reach 3
CALIBRATED             LOW FLOW      23/01/93,   ADULT     COVER
IOC           1100100100001000000O
QARD            150
QARD            300
QARD            450
QARD          684.2
XSEC              0 0.00.50            314.4      0.0024
                  0 0.0319.3     3.3318.4    4.6316.6    5.2317.0    7.5315.8    16.4315.8
                  0 27.9315.8    42.7316.3   54.8315.8   78.7315.5105.0315.1131.2315.1
                  0 157.5315.4183.7315.5210.0315.5236.2315.3262.5315.3288.7315.0
                  0 315.0314.9341.2314.6367.5314.6393.7314.6419.9314.5446.2314.4
                  0 472.4314.7498.7314.8524.9314.5551.2314.5579.1315.8585.6315.8
                  0 586.9316.1588.3318.5590.6319.3
NS                0        2.5          1           1           3           1          1
NS                0          1          1           1           1           1          1
NS                0        2.5          1         2.5           1           1          2
NS                0        2.5        2.5         2.5         2.5         2.5        2.5
NS                0        2.5          2           1         2.5         2.5        2.5
NS                0          3        2.5         2.5
WSL               0     315.25     315.46       315.6      315.75
CAL1              0     315.75     684.23
VEL1              0                                                                                                0.87     1.15     1.13
VEL1              0       0.99       0.27        0.51        0.89        0.64       2.02     2.11     2.41     2.24     2.89     2.21     3.05
VEL1              0       2.66       2.58        2.21        1.57
CAL2              0      316.6       3168
VEL2              0
VEL2              0
VEL2              0
CAL3              0     318.82      10374
VEL3              0
VEL3              0
VEL3              0
XSEC          372.6 372.60.50          314.4     0.00301
              372.6 0.0320.2     16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.3
```

TABLE VII-5

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

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```
           372.6 42.7314.2    52.5313.8    65.6314.0    82.0313.3    98.4313.6114.8313.2
           372.6 131.2313.3147.6312.2164.0313.0180.4313.9196.9313.2213.3313.5
           372.6 229.7314.1246.1314.0262.5314.4278.9313.8295.3313.8311.7313.4
           372.6 372.6328.1314.3344.5314.5360.9314.7377.3315.0393.7315.1410.1316.2
           372.6 413.4316.3418.0317.7419.9317.3420.6318.9422.6320.9
NS         372.6        1         1         1         1         1         1
NS         372.6        1         2         2         2         2         2
NS         372.6        2         2         2         2         1         1
NS         372.6        2         2         2         1         2         1
NS         372.6        1         1         1         1         1         1
NS         372.6        3         3       2.5       2.5       2.5
WSL        372.6   315.38    315.68     315.9    316.16
CAL1       372.6   316.26    684.23
VEL1       372.6                                                          0.96      0.88      0.81      0.82      0.85      0.85
VEL1       372.6     0.93      0.76      0.86      1.18      0.89      0.83      0.74      0.78      0.82      0.65      0.62      0.62
VEL1       372.6     0.69      0.69      0.61      0.54      0.51      0.18         0
CAL2       372.6   317.68    3168.8
VEL2       372.6
VEL2       372.6
VEL2       372.6
CAL3       372.6   319.86     10374
VEL3       372.6
VEL3       372.6
VEL3       372.6
XSEC       625.1 252.50.50          314.4      0.0015
           625.1 0.0320.1     6.6317.9     8.2317.2     13.5316.3    26.2314.8    39.4314.0
           625.1 52.5313.5    65.6313.2    78.7312.5    91.9313.0105.0313.5118.1313.6
           625.1 131.2314.0157.5313.7183.7314.0210.0314.1236.2313.9262.5314.4
           625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.3
           625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS         625.1      2.5       2.5       2.5       2.5       2.5       2.5
NS         625.1      2.5       2.5       2.5       2.5       2.5       2.5
NS         625.1      2.5       2.5       2.5       2.5       2.5         1
NS         625.1        1         1         1         1         1       2.5
NS         625.1      2.5         3         3         3
```

TABLE VII-5

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

(Page 3 of 7)

```
WSL     625.1   315.43   315.77   316.01   316.31
CAL1    625.1   316.31   684.23
VEL1    625.1                                        0.71     0.73   0.8     1    0.99     1   0.96   0.78
VEL1    625.1     0.94     0.88     0.87     0.94    1.06     1.02   0.96  0.71   0.56  0.41   0.31
VEL1    625.1
CAL2    625.1   317.82   3168.8
VEL2    625.1
VEL2    625.1
VEL2    625.1
CAL3    625.1   320.16    10374
VEL3    625.1
VEL3    625.1
VEL3    625.1
XSEC    952.2 327.20.50       314.4    0.00053
        952.2 0.0321.1    2.3318.0    16.4319.3   22.6316.2   26.2317.0   32.8316.5
        952.2 49.2314.4   65.6313.3   82.0313.2   98.4312.8114.8313.0131.2313.4
        952.2 147.6313.2164.0313.9180.4313.3196.9313.2213.3313.8229.7313.8
        952.2 246.1314.0262.5314.5278.9314.8295.3315.1311.7315.5328.1315.8
        952.2 344.5315.8360.9316.1377.3316.4388.1316.5393.7316.6397.0317.1
        952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS      952.2        1        2        1        1       2        2
NS      952.2        2        2        2        2       2        2
NS      952.2        2        2        1        1       1        1
NS      952.2        1        1        1        1       1        1
NS      952.2        1        1        1        1       1        3
NS      952.2        3      2.5      2.5      2.5
WSL     952.2   315.51   315.89   316.17   316.51
CAL1    952.2   316.46   684.23
VEL1    952.2                                                        0.42  0.88   0.85  0.97   1.16    1.2
VEL1    952.2      1.1     1.21     1.03     1.09    1.07     0.88   0.62  0.65   0.58  0.55    0.5   0.42
VEL1    952.2     0.24     0.22     0.09
CAL2    952.2   318.04   3168.8
CAL3    952.2    320.6    10374
ENDJ
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t4 reach 3
ADULT2          FEB 4           1993
IOC             11001000000010000000
QARD            1926
QARD            3168
QARD            6771
XSEC              0 0.00.30            314.1           0
                  0 0.0319.3    3.3318.4    4.6316.6    5.2316.1    7.5315.5    16.4315.2
                  0 27.9315.5   42.7315.6   54.8315.5   78.7315.2105.0314.8131.2315.0
                  0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                  0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                  0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                  0 586.9316.1588.3318.5590.6319.3
NS                0         2.5         1           1           3           1           1
NS                0         1           1           1           1           1           1
NS                0         2.5         1           2.5         1           1           2
NS                0         2.5         2.5         2.5         2.5         2.5         2.5
NS                0         2.5         2           1           2.5         2.5         2.5
NS                0         3           2.5         2.5
CAL1              0         315.75      684.2
CAL2              0         316.6       3446.1
VEL2              0                                             1.48        0.83        1.39     1.48     1.71     1.57     1.95     1.85     2.44
VEL2              0         2.69        3.08        3.25        3.08        3.31        1.05     3.9      4.17     5.74     3.33     4.04     5.09
VEL2              0         5.64        5.15        5.31        4.38        2.89
CAL3              0         318.82      10374
XSEC            372.6 372.60.50        314.1           0
                372.6 0.0320.2      16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.0
                372.6 42.7313.6     52.5314.1   65.6314.1   82.0313.4   98.4313.4114.8313.7
                372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
                372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
                372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
                372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
NS              372.6       1           1           1           1           1           1
NS              372.6       1           2           2           2           2           2
NS              372.6       2           2           2           2           1           1
NS              372.6       2           2           2           1           2           1
NS              372.6       1           1           1           1           1           1
NS              372.6       3           3           2.5         2.5         2.5
CAL1            372.6       316.21      684.2
CAL2            372.6       317.68      3446.1
```

TABLE VI-6

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

(Page 5 of 7)

VEL2	372.6				1.02	1.18	1.84	2.55	2.88	2.64	2.59	2.71	2.53
VEL2	372.6	2.47	2.42	2.5	2.38	2.6	2.56	2.7	2.74	2.51	2.64	2.47	2.47
VEL2	372.6	2.63	2.4	2.32	2.12	1.66	1.25	1.02					
CAL3	372.6	319.86	10374										
XSEC	625.1	252.50.50	314.1	0									
	625.1	0.0320.1	6.6317.8	8.2316.8	13.5316.2	26.2314.8	39.4313.9						
	625.1	52.5313.2	65.6313.2	78.7312.4	91.9313.2105.0313.9118.1313.9								
	625.1	131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4											
	625.1	288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4											
	625.1	412.7317.8414.0317.1414.1319.1415.7320.3											
NS	625.1	2.5	2.5	2.5	2.5	2.5	2.5						
NS	625.1	2.5	2.5	2.5	2.5	2.5	2.5						
NS	625.1	2.5	2.5	2.5	2.5	2.5	1						
NS	625.1	1	1	1	1	1	2.5						
NS	625.1	2.5	3	3	3								
CAL1	625.1	316.31	684.2										
CAL2	625.1	317.82	3446.1										
VEL2	625.1			0.39	1.42	1.94	2.44	2.01	2.8	2.79	2.78	2.84	2.65
VEL2	625.1	2.8	2.51	2.72	2.6	2.86	2.83	2.62	2.32	2.5	1.72	1.68	1.1
CAL3	625.1	320.16	10374										
XSEC	952.2	327.20.50	314.1	0									
	952.2	0.0321.1	2.3318.0	16.4319.3	22.6318.0	26.2316.9	32.8316.3						
	952.2	49.2314.4	65.6313.1	82.0313.5	98.4313.0114.8313.4131.2313.4								
	952.2	147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7											
	952.2	246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6											
	952.2	344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7											
	952.2	398.6318.0405.8319.5412.7318.0416.7322.1											
NS	952.2	1	2	1	1	2	2						
NS	952.2	2	2	2	2	2	2						
NS	952.2	2	2	1	1	1	1						
NS	952.2	1	1	1	1	1	1						
NS	952.2	1	1	1	1	1	3						
NS	952.2	3	2.5	2.5	2.5								
CAL1	952.2	316.47	684.2										
CAL2	952.2	318.04	3446.1										
VEL2	952.2					1.13	1.46	1.9	2.11	2.38	2.5	2.68	2.8
VEL2	952.2	2.79	2.6	3.04	2.67	2.61	2.52	2.47	1.95	1.85	1.95	2.01	1.91
VEL2	952.2	1.82	1.72	1.56	1.49	0.99	0						
CAL3	952.2	320.61	10374										
ENDJ													

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

(Page 6 of 7)

```
HIGH flow Red Deer River t1 to t4 reach 3
ADULT         FEB 4          1993
IOC          1100100100001000000
QARD        10374
QARD        15000
QARD        20000
QARD        30000
XSEC            0 0.00.30        314.1        0
                0 0.0319.3    3.3318.4    4.6316.6    5.2316.1    7.5315.5    16.4315.2
                0 27.9315.5   42.7315.6   54.8315.5   78.7315.2105.0314.8131.2315.0
                0 157.5315.2183.7315.4210.0315.3236.2315.0262.5315.0288.7314.8
                0 315.0314.6341.2314.3367.5314.8393.7314.1419.9314.2446.2314.4
                0 472.4314.4498.7314.6524.9314.6551.2314.3579.1315.6585.6316.6
                0 586.9316.1588.3318.5590.6319.3
NS              0       2.5         1         1         3         1         1
NS              0         1         1         1         1         1         1
NS              0       2.5         1       2.5         1         1         2
NS              0       2.5       2.5       2.5       2.5       2.5       2.5
NS              0       2.5         2         1       2.5       2.5       2.5
NS              0         3       2.5       2.5
WSL             0    318.82    320.06    321.28    319.25
CAL1            0     316.6    3446.1
VEL1            0
VEL1            0
VEL1            0
XSEC        372.6 372.60.50      314.1        0
            372.6 0.0320.2    16.4318.4   23.0317.7   26.2317.2   32.8316.9   37.7316.0
            372.6 42.7313.6   52.5314.1   65.6314.1   82.0313.4   98.4313.4114.8313.7
            372.6 131.2313.2147.6312.4164.0313.4180.4313.6196.9313.2213.3313.9
            372.6 229.7314.1246.1314.1262.5314.2278.9314.1295.3313.4311.7313.6
            372.6 328.1314.4344.5314.5360.9314.7377.3315.0393.7315.4410.1316.2
            372.6 413.4316.4418.0317.7419.9317.3420.6318.9422.6320.9
NS          372.6         1         1         1         1         1         1
NS          372.6         1         2         2         2         2         2
NS          372.6         2         2         2         2         1         1
NS          372.6         2         2         2         1         2         1
NS          372.6         1         1         1         1         1         1
NS          372.6         3         3       2.5       2.5       2.5
WSL         372.6    319.86    320.89    321.98    322.51
```

TABLE VII-5

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 3 WERE R3LOADU.IFG, R3MDADU.IFG, AND R3HIADU.IFG, RESPECTIVELY

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```
CAL1        372.6      317.68      3446.1
VEL1        372.6
VEL1        372.6
VEL1        372.6
XSEC        625.1 252.50.50        314.1           0
            625.1 0.0320.1    6.6317.8    8.2316.8    13.5316.2   26.2314.8   39.4313.9
            625.1 52.5313.2   65.6313.2   78.7312.4   91.9313.2105.0313.9118.1313.9
            625.1 131.2314.1157.5313.7183.7314.1210.0314.2236.2313.9262.5314.4
            625.1 288.7314.9315.0315.0341.2315.3367.5315.5393.7315.6407.5316.4
            625.1 412.7317.8414.0317.1414.1319.1415.7320.3
NS          625.1        2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1        2.5         2.5         2.5         2.5         2.5         2.5
NS          625.1        2.5         2.5         2.5         2.5         2.5           1
NS          625.1          1           1           1           1           1         2.5
NS          625.1        2.5           3           3           3
WSL         625.1     320.16      321.19      322.28      323.03
CAL1        625.1     317.82      3446.1
VEL1        625.1
VEL1        625.1
VEL1        625.1
XSEC        952.2 327.20.50        314.1           0
            952.2 0.0321.1    2.3318.0    16.4319.3   22.6318.0   26.2316.9   32.8316.3
            952.2 49.2314.4   65.6313.1   82.0313.5   98.4313.0114.8313.4131.2313.4
            952.2 147.6313.1164.0313.8180.4313.6196.9313.4213.3313.6229.7313.7
            952.2 246.1314.1262.5314.4278.9314.9295.3315.2311.7315.4328.1315.6
            952.2 344.5315.7360.9315.9377.3315.9388.1316.3393.7316.5397.0317.7
            952.2 398.6318.0405.8319.5412.7318.0416.7322.1
NS          952.2          1           2           1           1           2           2
NS          952.2          2           2           2           2           2           2
NS          952.2          2           2           1           1           1           1
NS          952.2          1           1           1           1           1           1
NS          952.2          1           1           1           1           1           3
NS          952.2          3         2.5         2.5         2.5
WSL         952.2     320.61      321.65      322.74      323.73
CAL1        952.2     318.04      3446.1
VEL1        952.2
VEL1        952.2
VEL1        952.2
ENDJ
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
LOW velocity calibration deck t1 to t6 reach 4
FRY       23/1/93    JJH
IOC            11001001000010000000
QARD             150
QARD             300
QARD             450
QARD             671
XSEC               0 0.00.50        318.1      0.003
                   0 0.0329.2   9.0329.2   9.1325.7   13.1324.4  18.0322.6  23.3321.0
                   0 29.5319.9  39.4320.0  49.2319.8  59.1320.0  68.9319.4  78.7319.3
                   0 88.6319.2  98.4319.6105.0319.2111.5319.6118.1319.7124.7319.3
                   0 131.2318.5137.8318.2144.4318.1150.9318.2157.5318.6164.0319.0
                   0 170.6319.8177.2320.8179.5321.0201.1322.6203.4322.4236.2323.3
                   0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                 0          1        2.5        2.5        2.5        2.5        2.5
NS                 0        2.5        2.5        2.5        2.5        2.5        2.5
NS                 0        2.5        2.5        2.5        2.5        2.5        2.7
NS                 0        2.5        2.5        2.5        2.5        2.5        2.5
NS                 0        2.5        2.5        2.5        2.5        2.5        2.5
NS                 0        2.5        2.5        2.5        2.5        2.5
WSL                0     319.99     320.37     320.64     320.96
CAL1               0     320.96     671.54
VEL1               0                                                                  0.87     1.08     0.98      0.8     1.31     1.49
VEL1               0       1.85       1.94       1.74       2.51       3.26       4.63  4.03     4.18     3.94     3.89     4.13     3.67
VEL1               0        2.9       0.69
CAL2               0     322.57    2742.17
VEL2               0
VEL2               0
VEL2               0
CAL3               0     325.16     6859.5
XSEC            85.5 85.50.50       318.1      0.0045
                85.5 0.0329.6   5.6329.7   6.6326.0   12.5323.0  19.7321.1  23.0321.7
                85.5 28.9321.1  36.1319.5  42.7318.6  49.2316.5  55.8314.6  62.3313.3
                85.5 68.9312.1  75.5311.4  80.4311.5  85.3312.5  90.2313.0  95.1313.7
                85.5 101.7315.1108.3317.3114.8318.6121.4319.0128.0319.8134.5320.5
                85.5 144.4321.1164.0322.3187.7323.0196.9322.9229.7323.4262.5323.2
                85.5 275.6323.1334.0325.4
NS              85.5          1        2.5        2.5        2.5          2          2
NS              85.5          1          2          2          2          2          2
NS              85.5          2          2          2          2          2          2
NS              85.5          2          2          2          2          2          2
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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NS	85.5	2	2	2	2	2	2						
NS	85.5	2.5	2.5										
WSL	85.5	320.04	320.46	320.76	321.11								
CAL1	85.5	321.12	671.54										
VEL1	85.5								0.31	0.37	0.9	0.82	1.06
VEL1	85.5	1.42	1.54	1.5	1.44	1.41	1.54	1.56	1.64	1.64	1.63	1.38	1
VEL1	85.5												
CAL2	85.5	322.97	2742.17										
VEL2	85.5												
VEL2	85.5												
VEL2	85.5												
CAL3	85.5	325.38	6859.5										
XSEC	177.9	92.40.40	318.1	0.0026									
	177.9	0.0329.2	11.8328.0	12.5326.4	19.7324.4	26.2323.3	29.5321.1						
	177.9	32.8318.5	36.1316.8	39.4314.3	42.7312.6	45.9313.9	49.2312.6						
	177.9	52.5311.9	55.8312.4	59.1312.2	62.3312.2	65.6312.5	68.9312.5						
	177.9	75.5314.0	82.0317.0	88.6318.1	95.1319.2101.7320.3111.5321.1								
	177.9	134.5322.0167.3322.5182.7323.3200.1323.2232.9323.5278.9323.5											
	177.9	317.3325.2											
NS	177.9	2.5	2.5	2.5	2.5	2.5	2.5						
NS	177.9	2.5	2.5	2.5	2.5	2.5	2.5						
NS	177.9	2.5	2.5	2	2	2	2						
NS	177.9	2	2	2	2	1	2						
NS	177.9	2	2	2	2	2	2.5						
NS	177.9	2.5											
WSL	177.9	320.05	320.47	320.77	321.14								
CAL1	177.9	321.14	671.54										
VEL1	177.9							0.28	2.32	2.5	2.54	2.54	2.31
VEL1	177.9	2.23	2.17	2	1.66	1.46	1.1	0.58	0.38	0.3	0.14	0	
VEL1	177.9												
CAL2	177.9	323.25	2742.17										
VEL2	177.9												
VEL2	177.9												
VEL2	177.9												
CAL3	177.9	325.48	6859.5										
XSEC	454	276.20.50	318.1	0.003									
	454	0.0330.1	2.4330.0	2.5324.4	6.6322.2	9.0321.3	13.1318.6						
	454	16.4317.3	19.7316.5	23.0316.0	26.2316.2	29.5316.4	32.8316.7						
	454	36.1317.3	39.4317.3	42.7318.4	45.9318.9	49.2319.1	52.5319.4						
	454	59.1319.8	65.6320.0	72.2320.4	78.7320.5	85.3320.6	91.9320.9						
	454	98.4321.1105.0321.2111.5321.1118.1321.2119.4321.3150.9321.7											

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
                454 183.7322.4216.5323.1236.2323.5249.3323.9282.2324.3323.2324.6
                454 345.1325.7360.9326.6
NS              454        1      2.5      2.5      2.5      2.5      2.5
NS              454      2.5      2.5      2.5      2.5      2.5      2.5
NS              454      2.5      2.5      2.5      2.5      2.5      2.5
NS              454      2.5      2.5      2.5      2.5      2.5      2.5
NS              454      2.5      2.5      2.5      2.5      2.5      2.5
NS              454      2.5      2.5      2.5      2.5      2.5      2.5
NS              454        1        1
WSL             454   320.09   320.56    320.9   321.28
CAL1            454   321.27   671.54
VEL1            454                                             2.92     4.59     4.76     5.33     5.09     4.59     4.02
VEL1            454     3.61     3.05     2.56     2.62     2.56     2.23     1.77     1.15     0.82     0.66     0.36     0.16
VEL1            454        0        0        0        0
VEL1            454
CAL2            454   323.55  2742.17
VEL2            454
VEL2            454
VEL2            454
VEL2            454
CAL3            454   326.02   6859.5
XSEC            732 277.90.50    319.1   0.0027
                732 0.0327.4  3.6327.7  3.7324.8  4.9324.6  6.2324.0  8.2322.2
                732 10.2321.9 13.1320.3 19.7319.1 26.2319.5 32.8319.7 39.4319.9
                732 45.9320.3 52.5320.0 59.1319.9 65.6319.7 72.2319.9 78.7320.2
                732 85.3320.3 91.9320.1 98.4320.1108.3320.3118.1320.4128.0320.3
                732 137.8320.5147.6320.9157.5321.3167.3321.8169.9321.9196.9322.7
                732 229.7323.6237.9324.0262.5324.3289.6324.6399.1326.3410.1326.5
NS              732        1      2.5      2.5      2.5      2.5      2.5
NS              732      2.5      2.5      2.5      2.5      2.5      2.5
NS              732      2.5      2.5      2.5      2.5      2.5      2.5
NS              732      2.5      2.5      2.5      2.5      2.5      2.5
NS              732      2.5      2.5      2.5      2.5      2.5      2.5
NS              732      2.5      2.5      2.5      2.5        2        2
WSL             732    320.8   321.91   321.52   321.91
CAL1            732   321.91   671.54
VEL1            732                                                               1.52     2.59     2.21     2.21     2.46
VEL1            732      2.7     2.63     2.63     2.49     2.58     2.27     2.52     2.21     1.96     2.02     2.11        2
VEL1            732     1.61      1.4     0.01        0
CAL2            732   324.03  2742.17
VEL2            732
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL2       732
VEL2       732
CAL3       732    326.43     6859.5
VEL3       732
VEL3       732
VEL3       732
XSEC     923.4 191.40.00      319.1      0.001
         923.4 0.0328.3   12.8324.2  16.4322.1  22.5316.9  23.0319.5  36.1316.5
         923.4 42.7316.7  49.2317.4  55.8318.1  62.3318.5  68.9319.0  75.5319.6
         923.4 82.0319.5  88.6319.5  95.1319.6101.7319.7108.3320.1114.8320.3
         923.4 121.4320.4128.0320.8134.5321.1141.1321.4147.6321.7154.9322.1
         923.4 164.0322.6180.4323.4193.9324.2196.9324.4229.7326.2262.5326.6
         923.4 282.2325.2364.2326.5374.0326.6
NS       923.4       2.5        2.5          2          2          2          2
NS       923.4         2          2          2          2          1          1
NS       923.4         1          1          2          1          2          2
NS       923.4         2          1          1          1          2          2
NS       923.4         2          2          2        2.5        2.5        2.5
NS       923.4       2.5        2.5        2.5
WSL      923.4     320.9     321.96     321.69      322.1
CAL1     923.4    321.93     671.54
VEL1     923.4                                       1.32       1.67       1.78       1.78       1.72        1.7       1.74       1.73        1.7
VEL1     923.4      1.71       1.46       1.28       1.35       1.08       1.13       0.83       0.74       0.68       0.39       0.17
VEL1     923.4
CAL2     923.4    324.24    2742.17
VEL2     923.4
VEL2     923.4
VEL2     923.4
CAL3     923.4    326.54     6859.5
VEL3     923.4
VEL3     923.4
VEL3     923.4
ENDJ
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t4 reach 4
FRY2    MED     FLOW      FEB 4       1993
IOC       1100100000001000000 0
QARD      1554
QARD      2437
QARD      4648
XSEC         0 0.00.50     318.3       0
             0 0.0329.2 9.0329.2 9.1325.7 13.1324.  18.0322.  23.3321.1
             0 29.5320. 39.4320. 49.2320. 59.1320.  68.9320.  78.7319.6
             0 88.6319. 98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
               131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
               170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
               269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS           0        1      2.5      2.5      2.5      2.5      2.5
NS           0      2.5      2.5      2.5      2.5      2.5      2.5
NS           0      2.5      2.5      2.5      2.5      2.5      2.5
NS           0      2.5      2.5      2.5      2.5      2.5      2.5
NS           0      2.5      2.5      2.5      2.5      2.5      2.5
NS           0      2.5      2.5      2.5      2.5      2.5
CAL1         0   320.96   671.54
CAL2         0   322.57   2497.6
VEL2         0                                                4.43     4.87     4.92     5.13     5.07     5.79     5.36
VEL2         0     5.04     5.61     6.19     5.49     4.99     5.24     6.23     5.94     5.82     5.05     5.36     4.89
VEL2         0     4.83     3.51     3.22
CAL3         0   325.16   6859.5
XSEC      85.5 85.50.50    318.3        0
          85.5 0.0329.6 5.6329.7 6.6326.0 12.5323. 19.7320. 23.0321.1
          85.5 28.9321. 36.1318. 42.7318. 49.2316. 55.8315. 62.3314.8
          85.5 68.9314. 75.5315. 80.4315. 85.3315. 90.2315. 95.1315.8
          85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
          85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
          85.5 275.6323.1334.0325.4
NS        85.5        1      2.5      2.5      2.5        2        2
NS        85.5        1        2        2        2        2        2
NS        85.5        2        2        2        2        2        2
NS        85.5        2        2        2        2        2        2
NS        85.5        2        2        2        2        2        2
NS        85.5      2.5      2.5
CAL1      85.5   321.12   671.54
CAL2      85.5   322.97   2497.6
VEL2      85.5                                       0.72     0.46     0.36     1.73     2.14     2.73      3.8     4.84
VEL2      85.5      5.5     5.19     5.06      4.8      4.7     4.83     4.83      4.7     4.66     3.91     2.47      2.8
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY
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```
VEL2      85.5     1.67     1.33
CAL3      85.5   325.38   6859.5
XSEC     177.9 92.40.30    318.3        0
         177.9 0.0329.2 11.8328.  12.5326.  19.7324.  26.2323.  29.5321.2
         177.9 32.8319.  36.1316.  39.4314.  42.7312.  45.9313.  49.2312.6
         177.9 52.5312.  55.8313.  59.1313.  62.3313.  65.6313.  68.9313.2
         177.9 75.5313.  82.0316.  88.6318.  95.1319.8101.7320.0111.5320.6
         177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
         177.9 317.3325.2
NS       177.9      2.5      2.5      2.5      2.5      2.5      2.5
NS       177.9      2.5      2.5      2.5      2.5      2.5      2.5
NS       177.9      2.5      2.5        2        2        2        2
NS       177.9        2        2        2        2        1        2
NS       177.9        2        2        2        2        2      2.5
NS       177.9      2.5
CAL1     177.9   321.14   671.54
CAL2     177.9   323.25   2497.6
VEL2     177.9                                           0.34     1.49      4.8     5.43     5.13     5.64     5.74
VEL2     177.9     5.87     5.77     5.53     5.41     5.19     5.21     4.66      4.1     3.83     3.44     3.37     2.88
VEL2     177.9     1.74     0.73
CAL3     177.9   325.48    689.5
XSEC       454 276.20.5    318.3        0
           454 0.0330.1 2.5330.0 2.6323.5 6.6321.7 9.0319.6 13.1317.6
           454 16.4317.  19.7316.  23.0316.  26.2316.  29.5316.  32.8316.7
           454 36.1317.  39.4318.  42.7318.  45.9319.  49.2319.  54.5319.4
           454 59.1320.  65.6320.  70.2320.  78.7320.  85.3320.  91.9321.1
           454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
           454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
           454 345.1325.7360.9326.6
NS         454        1      2.5      2.8      2.5      2.5      2.5
NS         454      2.5      2.5      2.5      2.5      2.5      2.5
NS         454      2.5      2.5      2.5      2.5      2.5      2.5
NS         454      2.5      2.5      2.5      2.5      2.5      2.5
NS         454      2.5      2.5      2.5      2.5      2.5      2.5
NS         454      2.5      2.5      2.5      2.5      2.5      2.5
NS         454        1        1
CAL1       454   321.27   671.54
CAL2       454   323.55   2497.6
VEL2       454                                  0     1.35      4.6     4.65      5.1      5.4     5.52     5.27     5.27
VEL2       454     5.12     4.67     5.02     5.06     4.92     4.88     4.98     5.01     4.96     4.55     4.42     4.04
VEL2       454     4.41     4.05     4.31        4     4.69        0        0        0
VEL2       454
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
CAL3     454   326.02   6859.5
XSEC     732 277.90.5    319.1       0
         732 0.0327.4 3.6327.7 3.7324.8 4.9324.6 6.2324.0 8.2322.2
         732 10.2321. 13.1320. 19.7319. 26.2319. 32.8319. 39.4320.1
         732 45.9319. 52.5319. 59.1320. 65.6320. 72.2320. 78.7320.1
         732 85.3320. 91.9320. 98.4320.3108.3320.3118.1320.3128.0320.5
         732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
         732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS       732        1      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5        2        2
CAL1     732   321.91   671.54
CAL2     732   324.03   2497.6
VEL2     732
VEL2     732                                                    0     0.18     1.06     3.73     4.06     4.28     4.66
VEL2     732      4.5     5.07     4.62     4.74     4.72     5.06     4.78     4.43     4.68     4.77     4.31     4.39
VEL2     732     3.99     4.24     3.93     3.79     3.95     2.58     0.08
CAL3     732   326.43   6859.5
XSEC   923.4 191.40.0    319.1       0
       923.4 0.0328.3 12.6324. 16.4322. 22.0318. 23.5317. 36.1316.2
       923.4 42.7316. 49.2317. 55.8318. 62.3318. 68.9319. 75.5319.3
       923.4 82.0319. 88.6319. 95.1319.6101.7319.9108.3320.0114.8320.4
       923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
       923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
       923.4 282.2325.2364.2326.5374.0326.6
NS     923.4      2.5      2.5        2        2        2        2
NS     923.4        2        2        2        2        1        1
NS     923.4        1        1        2        1        2        2
NS     923.4        2        1        1        1        2        2
NS     923.4        2        2        2      2.5      2.5      2.5
NS     923.4      2.5      2.5      2.5
CAL1   923.4   321.93   671.54
CAL2   923.4   324.24   2497.6
VEL2   923.4
VEL2   923.4                       2.65     3.86     3.53     3.96     3.68     4.15     4.25     3.93     4.23     4.04
VEL2   923.4     3.77     3.88     3.77     3.81     3.93     3.24     2.94     2.96     2.58     2.78     2.51     2.23
VEL2   923.4     1.88     0.84
CAL3   923.4   326.54   6859.5
ENDJ
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
HIGH Flow Red Deer River t1 to t4 reach 4
FRY      HI         FLOW            FEB 4          1993
IOC            11101001000010000000
QARD            6859
QARD           10000
QARD           15000
QARD           20000
XSEC               0 0.00.50          318.3           0
                   0 0.0329.2    9.0329.2    9.1325.7    13.1324.4    18.0322.6    23.3321.1
                   0 29.5320.1   39.4320.3   49.2320.1   59.1320.2    68.9320.0    78.7319.6
                   0 88.6319.5   98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                   0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                   0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                   0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                 0          1         2.5         2.5          2.5          2.5          2.5
NS                 0        2.5         2.5         2.5          2.5          2.5          2.5
NS                 0        2.5         2.5         2.5          2.5          2.5          2.5
NS                 0        2.5         2.5         2.5          2.5          2.5          2.5
NS                 0        2.5         2.5         2.5          2.5          2.5          2.5
NS                 0        2.5         2.5         2.5          2.5          2.5
WSL                0     325.16      326.41      328.11       329.64
CAL1               0     322.57     2497.56
VEL1               0
VEL1               0
VEL1               0
XSEC            85.5 85.50.50         318.3           0
                85.5 0.0329.6    5.6329.7    6.6326.0    12.5323.0    19.7320.8    23.0321.1
                85.5 28.9321.5   36.1318.4   42.7318.1   49.2316.7    55.8315.8    62.3314.8
                85.5 68.9314.4   75.5315.1   80.4315.4   85.3315.4    90.2315.4    95.1315.8
                85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
                85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
                85.5 275.6323.1334.0325.4
NS              85.5          1         2.5         2.5          2.5            2            2
NS              85.5          1           2           2            2            2            2
NS              85.5          2           2           2            2            2            2
NS              85.5          2           2           2            2            2            2
NS              85.5          2           2           2            2            2            2
NS              85.5        2.5         2.5
WSL             85.5      325.4      326.59      328.26       329.76
CAL1            85.5     322.97     2497.56
```

F4

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL1        85.5
VEL1        85.5
VEL1        85.5
XSEC        177.9 92.40.30        318.3          0
            177.9 0.0329.2    11.8328.0   12.5326.4   19.7324.4   26.2323.2   29.5321.2
            177.9 32.8319.2   36.1316.6   39.4314.1   42.7312.4   45.9313.4   49.2312.6
            177.9 52.5312.8   55.8313.1   59.1313.1   62.3313.1   65.6313.1   68.9313.2
            177.9 75.5313.8   82.0316.8   88.6318.7   95.1319.8101.7320.0111.5320.6
            177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
            177.9 317.3325.2
NS          177.9        2.5         2.5         2.5         2.5         2.5         2.5
NS          177.9        2.5         2.5         2.5         2.5         2.5         2.5
NS          177.9        2.5         2.5           2           2           2           2
NS          177.9          2           2           2           2           2           2
NS          177.9          2           2           2           2           1           2
NS          177.9        2.5
WSL         177.9     325.53      326.72      328.37      329.86
CAL1        177.9     323.25     2497.56
VEL1        177.9
VEL1        177.9
VEL1        177.9
XSEC          454 276.20.50       318.3          0
              454 0.0330.1    2.5330.0    2.6323.5    6.6321.7    9.0319.6    13.1317.6
              454 16.4317.6   19.7316.5   23.0316.0   26.2316.2   29.5316.2   32.8316.7
              454 36.1317.1   39.4318.0   42.7318.6   45.9319.0   49.2319.1   54.5319.4
              454 59.1320.1   65.6320.3   70.2320.3   78.7320.8   85.3320.6   91.9321.1
              454 98.[illegible]321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
              454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
              454 345.1325.7360.9326.6
NS            454          1         2.5         2.5         2.5         2.5         2.5
NS            454        2.5         2.5         2.5         2.5         2.5         2.5
NS            454        2.5         2.5         2.5         2.5         2.5         2.5
NS            454        2.5         2.5         2.5         2.5         2.5         2.5
NS            454        2.5         2.5         2.5         2.5         2.5         2.5
NS            454        2.5         2.5         2.5         2.5         2.5         2.5
NS            454          1           1
WSL           454     326.09      327.34      329.02      330.51
CAL1          454     323.55     2497.56
VEL1          454
VEL1          454
```

TABLE VII-6

FILES FOR FLOW SIMULATIONS WITH FRY-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL1       454
VEL1       454
XSEC       732 277.90.50       319.1          0
           732 0.0327.4     3.6327.7     3.7324.8     4.9324.6     6.2324.0     8.2322.2
           732 10.2321.4    13.1320.1    19.7319.1    26.2319.5    32.8319.8    39.4320.1
           732 45.9319.8    52.5319.9    59.1320.3    65.6320.1    72.2320.3    78.7320.1
           732 85.3320.3    91.9320.1    98.4320.3108.3320.3118.1320.3128.0320.5
           732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
           732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS         732            1          2.5          2.5          2.5          2.5          2.5
NS         732          2.5          2.5          2.5          2.5          2.5          2.5
NS         732          2.5          2.5          2.5          2.5          2.5          2.5
NS         732          2.5          2.5          2.5          2.5          2.5          2.5
NS         732          2.5          2.5          2.5          2.5          2.5          2.5
NS         732          2.5          2.5          2.5          2.5            2            2
WSL        732       326.43       327.62       329.19       330.53
CAL1       732       324.04      2497.56
VEL1       732
VEL1       732
VEL1       732
XSEC     923.4 191.40.00       319.1          0
         923.4 0.0328.3     12.8324.2    16.4322.1    22.0318.7    23.5317.1    36.1316.2
         923.4 42.7316.6    49.2317.4    55.8318.2    62.3318.7    68.9319.2    75.5319.3
         923.4 82.0319.5    88.6319.5    95.1319.6101.7319.9108.3320.0114.8320.4
         923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
         923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
         923.4 282.2325.2364.2326.5374.0326.6
NS       923.4          2.5          2.5            2            2            2            2
NS       923.4            2            2            2            2            1            1
NS       923.4            1            1            2            1            2            2
NS       923.4            2            1            1            1            2            2
NS       923.4            2            2            2          2.5          2.5          2.5
NS       923.4          2.5          2.5          2.5
WSL      923.4       326.54       327.71       329.26       330.59
CAL1     923.4       324.24      2497.56
VEL1     923.4
VEL1     923.4
VEL1     923.4
ENDJ
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
LOW velocity calibration deck t1 to t6 reach 4
JUVENIL      23/1/93        JJH
IOC            11001001000010000000
QARD             150
QARD             300
QARD             450
QARD             671
XSEC               0 0.00.50           318.1        0.003
                   0 0.0329.2     9.0329.2     9.1325.7     13.1324.4    18.0322.6    23.3321.0
                   0 29.5319.9    39.4320.0    49.2319.8    59.1320.0    68.9319.4    78.7319.3
                   0 88.6319.2    98.4319.6105.0319.2111.5319.6118.1319.7124.7319.3
                   0 131.2318.5137.8318.2144.4318.1150.9318.2157.5316.6164.0319.0
                   0 170.6319.8177.2320.8179.5321.0201.1322.6203.4322.4236.2323.3
                   0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                 0           1          2.5          2.5          2.5          2.5          2.5
NS                 0         2.5          2.5            3            3          2.5          2.5
NS                 0         2.5          2.5          2.5          2.5          2.5          2.5
NS                 0         2.5          2.5          2.5          2.5          2.5          2.5
NS                 0         2.5          2.5            1            1          2.5          2.5
NS                 0         2.5            1          2.5          2.5          2.5
WSL                0      319.99       320.37       320.64       320.96
CAL1               0      320.96       671.54
VEL1               0                                                                          0.87      1.08      0.98       0.8      1.31      1.49
VEL1               0        1.85         1.94         1.74         2.51         3.26         4.63      4.03      4.18      3.94      3.89      4.13      3.67
VEL1               0         2.9         0.69
CAL2               0      322.57      2742.17
VEL2               0
VEL2               0
VEL2               0
CAL3               0      325.16       6859.5
XSEC            85.5 85.50.50          318.1        0.0045
                85.5 0.0329.6     5.6329.7     6.6326.0     12.5323.0    19.7321.1    23.0321.7
                85.5 28.9321.1    36.1319.5    42.7318.6    49.2316.5    55.8314.6    62.3313.3
                85.5 68.9312.1    75.5311.4    80.4311.5    85.3312.5    90.2313.0    95.1313.7
                85.5 101.7315.1108.3317.3114.8318.6121.4319.0128.0319.8134.5320.5
                85.5 144.4321.1164.0322.3187.7323.0196.9322.9229.7323.4262.5323.2
                85.5 275.6323.1334.0325.4
NS              85.5           1          2.5          2.5          2.5            1            1
NS              85.5           1            1            1            2            2            2
NS              85.5           2            2            2            2            1            1
NS              85.5           2            1            1            1            1            1
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
NS            85.5         1         1         1         1         1         1
NS            85.5       2.5       2.5
WSL           85.5    320.04    320.46    320.76    321.11
CAL1          85.5    321.12    671.54
VEL1          85.5                                                                     0.31      0.37       0.9      0.82      1.06
VEL1          85.5      1.42      1.54       1.5      1.44      1.41      1.54      1.56      1.64      1.64      1.63      1.38         1
VEL1          85.5
CAL2          85.5    322.97   2742.17
VEL2          85.5
VEL2          85.5
VEL2          85.5
CAL3          85.5    325.38    6859.5
XSEC         177.9 92.40.40       318.1     0.0026
             177.9 0.0329.2   11.8328.0  12.5326.4  19.7324.4  26.2323.3  29.5321.1
             177.9 32.8318.5  36.1316.8  39.4314.3  42.7312.6  45.9313.9  49.2312.6
             177.9 52.5311.9  55.8312.4  59.1312.2  62.3312.2  65.6312.5  68.9312.5
             177.9 75.5314.0  82.0317.0  88.6318.1  95.1319.2101.7320.3111.5321.1
             177.9 134.5322.0167.3322.5182.7323.3200.1323.2232.9323.5278.9323.5
             177.9 317.3325.2
NS           177.9         2         2         2         2         2         2
NS           177.9         2         2         2         2       2.5       2.5
NS           177.9         2         2         2         2         2         2
NS           177.9         2         1         1         1         1         1
NS           177.9         1         1         1         1         2       2.5
NS           177.9       2.5
WSL          177.9    320.05    320.47    320.77    321.14
CAL1         177.9    321.14    671.54
VEL1         177.9                                                           0.28      2.32       2.5      2.54      2.54      2.31
VEL1         177.9      2.23      2.17         2      1.66      1.46       1.1      0.58      0.38       0.3      0.14         0
VEL1         177.9
CAL2         177.9    323.25   2742.17
VEL2         177.9
VEL2         177.9
VEL2         177.9
CAL3         177.9    325.48    6859.5
XSEC           454 276.20.50      318.1     0.003
               454 0.0330.1    2.4330.0   2.5324.4   6.6322.2   9.0321.3  13.1318.6
               454 16.4317.3  19.7316.5  23.0316.0  26.2316.2  29.5316.4  32.8316.7
               454 36.1317.3  39.4317.3  42.7318.4  45.9318.9  49.2319.1  52.5319.4
               454 59.1319.8  65.6320.0  72.2320.4  78.7320.5  85.3320.6  91.9320.9
               454 98.4321.1105.0321.2111.5321.1118.1321.2119.4321.3150.9321.7
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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	454	183.7322.4216.5323.1236.2323.5249.3323.9282.2324.3323.2324.6											
	454	345.1325.7360.9326.6											
NS	454	1	2.5	2.5	2.5	2.5	2.5						
NS	454	2.5	2.5	2.5	2.5	2.5	2.5						
NS	454	2.5	2	2	2	2.5	2.5						
NS	454	2	2.5	2	2	2	2						
NS	454	2	2	2	2	2	2						
NS	454	2	2	2	2.5	2	1						
NS	454	1	1										
WSL	454	320.09	320.56	320.9	321.28								
CAL1	454	321.27	671.54										
VEL1	454						2.92	4.59	4.76	5.33	5.09	4.59	4.02
VEL1	454	3.61	3.05	2.56	2.62	2.56	2.23	1.77	1.15	0.82	0.66	0.36	0.16
VEL1	454	0	0	0	0								
VEL1	454												
CAL2	454	323.55	2742.17										
VEL2	454												
VEL2	454												
VEL2	454												
VEL2	454												
CAL3	454	326.02	6859.5										
XSEC	732	277.90.50	319.1	0.0027									
	732	0.0327.4	3.6327.7	3.7324.8	4.9324.6	6.2324.0	8.2322.2						
	732	10.2321.9	13.1320.3	19.7319.1	26.2319.5	32.8319.7	39.4319.9						
	732	45.9320.3	52.5320.0	59.1319.9	65.6319.7	72.2319.9	78.7320.2						
	732	85.3320.3	91.9320.1	98.4320.1108.3320.3118.1320.4128.0320.3									
	732	137.8320.5147.6320.9157.5321.3167.3321.8169.9321.9196.9322.7											
	732	229.7323.6237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5											
NS	732	1	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	1	1	1						
WSL	732	320.8	321.91	321.52	321.91								
CAL1	732	321.91	671.54										
VEL1	732								1.52	2.59	2.21	2.21	2.46
VEL1	732	2.7	2.63	2.63	2.49	2.58	2.27	2.52	2.21	1.96	2.02	2.11	2
VEL1	732	1.61	1.4	0.91	0								
CAL2	732	324.03	2742.17										
VEL2	732												

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL2        732
VEL2        732
CAL3        732      326.43      6859.5
VEL3        732
VEL3        732
VEL3        732
XSEC        923.4 191.40.00          319.1        0.001
            923.4 0.0328.3     12.8324.2    16.4322.1    22.5316.9    23.0319.5    36.1316.5
            923.4 42.7316.7    49.2317.4    55.8316.1    62.3318.5    68.9319.0    75.5319.6
            923.4 82.0319.5    88.6319.5    95.1319.6101.7319.7108.3320.1114.8320.3
            923.4 121.4320.4128.0320.8134.5321.1141.1321.4147.6321.7154.9322.1
            923.4 164.0322.6180.4323.4193.9324.2196.9324.4229.7326.2262.5326.6
            923.4 282.2325.2364.2326.5374.0326.6
NS          923.4         2.5         2.5           2           2           2           2
NS          923.4           2           2           1           1           1           1
NS          923.4           1           1           1           1           1           1
NS          923.4           1           1           1           1           1           1
NS          923.4           1           1           2         2.5         2.5         2.5
NS          923.4         2.5         2.5         2.5
WSL         923.4       320.9      321.96      321.69       322.1
CAL1        923.4      321.93      671.54
VEL1        923.4                                            1.32        1.67        1.78      1.78      1.72       1.7      1.74      1.73       1.7
VEL1        923.4        1.71        1.46        1.28        1.35        1.08        1.13      0.83      0.74      0.68      0.39      0.17
VEL1        923.4
CAL2        923.4      324.24     2742.17
VEL2        923.4
VEL2        923.4
VEL2        923.4
CAL3        923.4      326.54      6859.5
VEL3        923.4
VEL3        923.4
VEL3        923.4
ENDJ
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
med flow Red Deer River t1 to t4 reach 4
JUVENIL   FLOW      FEB 4          1993
IOC         11001000000010000000
QARD        1554
QARD        2437
QARD        4648
XSEC           0 0.00.50          318.3          0
               0 0.0329.2    9.0329.2    9.1325.7    13.1324.4   18.0322.6   23.3321.1
               0 29.5320.1   39.4320.3   49.2320.1   59.1320.2   68.9320.0   78.7319.6
               0 88.6319.5   98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
               0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
               0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
               0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS             0         1       2.5       2.5       2.5       2.5       2.5
NS             0       2.5       2.5         3         3       2.5       2.5
NS             0       2.5       2.5       2.5       2.5       2.5       2.5
NS             0       2.5       2.5       2.5       2.5       2.5       2.5
NS             0       2.5       2.5         1         1       2.5       2.5
NS             0       2.5         1       2.5       2.5       2.5
CAL1           0    320.96    671.54
CAL2           0    322.57    2497.6
VEL2           0                                                        4.43      4.87      4.92      5.13      5.07      5.79      5.36
VEL2           0      5.04      5.61      6.19      5.49      4.99      5.24      6.23      5.94      5.82      5.05      5.36      4.89
VEL2           0      4.83      3.51      3.22
CAL3           0    325.16    6859.5
XSEC        85.5 85.50.50         318.3          0
            85.5 0.0329.6    5.6329.7    6.6326.0    12.5323.0   19.7320.8   23.0321.1
            85.5 28.9321.5   36.1318.4   42.7318.1   49.2316.7   55.8315.8   62.3314.8
            85.5 68.9314.4   75.5315.1   80.4315.4   85.3315.4   90.2315.4   95.1315.8
            85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
            85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
            85.5 275.6323.1334.0325.4
NS          85.5         1       2.5       2.5       2.5         1         1
NS          85.5         1         1         1         2         2         2
NS          85.5         2         2         2         2         1         1
NS          85.5         2         1         1         1         1         1
NS          85.5         1         1         1         1         1         1
NS          85.5       2.5       2.5
CAL1        85.5    321.12    671.54
CAL2        85.5    322.97    2497.6
VEL2        85.5                                              0.72      0.46      0.36      1.73      2.14      2.73       3.8      4.84
VEL2        85.5       5.5      5.19      5.06       4.8       4.7      4.83      4.83       4.7      4.66      3.91      2.47       2.8
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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VEL2	85.5	1.67	1.33											
CAL3	85.5	325.38	6859.5											
XSEC	177.9	92.40.30	318.3	0										
	177.9	0.0329.2	11.8328.0	12.5326.4	19.7324.4	26.2323.2	29.5321.2							
	177.9	32.8319.2	36.1316.6	39.4314.1	42.7312.4	45.9313.4	49.2312.6							
	177.9	52.5312.8	55.8313.1	59.1313.1	62.3313.1	65.6313.1	68.9313.2							
	177.9	75.5313.8	82.0316.8	88.6318.7	95.1319.8101.7320.0111.5320.6									
	177.9	134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5												
	177.9	317.3325.2												
NS	177.9	2	2	2	2	2	2							
NS	177.9	2	2	2	2	2.5	2.5							
NS	177.9	2	2	2	2	2	2							
NS	177.9	2	1	1	1	1	1							
NS	177.9	1	1	1	1	2	2.5							
NS	177.9	2.5												
CAL1	177.9	321.14	671.54											
CAL2	177.9	323.25	2497.6											
VEL2	177.9						0.34	1.49	4.8	5.43	5.13	5.64	5.74	
VEL2	177.9	5.87	5.77	5.53	5.41	5.19	5.21	4.66	4.1	3.83	3.44	3.37	2.88	
VEL2	177.9	1.74	0.73											
CAL3	177.9	325.48	6859.5											
XSEC	454	276.20.50	318.3	0										
	454	0.0330.1	2.5330.0	2.6323.5	6.6321.7	9.0319.6	13.1317.6							
	454	16.4317.6	19.7316.5	23.0316.0	26.2316.2	29.5316.2	32.8316.7							
	454	36.1317.1	39.4318.0	42.7318.6	45.9319.0	49.2319.1	54.5319.4							
	454	59.1320.1	65.6320.3	70.2320.3	78.7320.8	85.3320.6	91.9321.1							
	454	98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9												
	454	183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6												
	454	345.1325.7360.9326.6												
NS	454	1	2.5	2.5	2.5	2.5	2.5							
NS	454	2.5	2.5	2.5	2.5	2.5	2.5							
NS	454	2.5	2	2	2	2.5	2.5							
NS	454	2	2.5	2	2	2	2							
NS	454	2	2	2	2	2	2							
NS	454	2	2	2	2.5	2	1							
NS	454	1	1											
CAL1	454	321.27	671.54											
CAL2	454	323.55	2497.6											
VEL2	454				0	1.35	4.6	4.65	5.1	5.4	5.52	5.27	5.27	
VEL2	454	5.12	4.67	5.02	5.06	4.92	4.88	4.98	5.01	4.96	4.55	4.42	4.04	
VEL2	454	4.41	4.05	4.31	4	4.69	0	0	0					
CAL3	454	326.02	6859.5											

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

(Page 7 of 10)

```
XSEC         732 277.90.50       319.1         0
             732 0.0327.4   3.6327.7   3.7324.8   4.9324.6   6.2324.0   8.2322.2
             732 10.2321.4  13.1320.1  19.7319.1  26.2319.5  32.8319.8  39.4320.1
             732 45.9319.8  52.5319.9  59.1320.3  65.6320.1  72.2320.3  78.7320.1
             732 85.3320.3  91.9320.1  98.4320.3108.3320.3118.1320.3128.0320.5
             732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
             732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS           732          1        2.5        2.5        2.5        2.5        2.5
NS           732        2.5        2.5        2.5        2.5        2.5        2.5
NS           732        2.5        2.5        2.5        2.5        2.5        2.5
NS           732        2.5        2.5        2.5        2.5        2.5        2.5
NS           732        2.5        2.5        2.5        2.5        2.5        2.5
NS           732        2.5        2.5        2.5          1          1          1
CAL1         732     321.91     671.54
CAL2         732     324.03     2497.6
VEL2         732                                                               0     0.18     1.06     3.73     4.06     4.28     4.66
VEL2         732        4.5       5.07       4.62       4.74       4.72       5.06     4.78     4.43     4.68     4.77     4.31     4.39
VEL2         732       3.99       4.24       3.93       3.79       3.95       2.58     0.08
CAL3         732     326.43     6859.5
XSEC       923.4 191.40.00       319.1         0
           923.4 0.0328.3   12.8324.2  16.4322.1  22.0318.7  23.5317.1  36.1316.2
           923.4 42.7316.6  49.2317.4  55.8318.2  62.3318.7  68.9319.2  75.5319.3
           923.4 82.0319.5  88.6319.5  95.1319.6101.7319.9108.3320.0114.8320.4
           923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
           923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
           923.4 282.2325.2364.2326.5374.0326.6
NS         923.4        2.5        2.5          2          2          2          2
NS         923.4          2          2          1          1          1          1
NS         923.4          1          1          1          1          1          1
NS         923.4          1          1          1          1          1          1
NS         923.4          1          1          2        2.5        2.5        2.5
NS         923.4        2.5        2.5        2.5
CAL1       923.4     321.93     671.54
CAL2       923.4     324.24     2497.6
VEL2       923.4                            2.65       3.86       3.53       3.96     3.68     4.15     4.25     3.93     4.23     4.04
VEL2       923.4       3.77       3.88       3.77       3.81       3.93       3.24     2.94     2.96     2.58     2.78     2.51     2.23
VEL2       923.4       1.88       0.84
CAL3       923.4     326.54     6859.5
ENDJ
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
HIGH Flow Red Deer River t1 to t4 reach 4
JUVENIL      HI     FLOW           FEB 4          1993
IOC     1.1001E+19
QARD          6859
QARD         10000
QARD         15000
QARD         20000
XSEC             0 0.00.50          318.3          0
                 0 0.0329.2     9.0329.2     9.1325.7     13.1324.4    18.0322.6    23.3321.1
                 0 29.5320.1    39.4320.3    49.2320.1    59.1320.2    68.9320.0    78.7319.6
                 0 88.6319.5    98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                 0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                 0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                 0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS               0          1          2.5          2.5          2.5          2.5          2.5
NS               0        2.5          2.5            3            3          2.5          2.5
NS               0        2.5          2.5          2.5          2.5          2.5          2.5
NS               0        2.5          2.5          2.5          2.5          2.5          2.5
NS               0        2.5          2.5            1            1          2.5          2.5
NS               0        2.5            1          2.5          2.5          2.5
WSL              0     325.16       326.41       328.11       329.64
CAL1             0     322.57      2497.56
VEL1             0
VEL1             0
VEL1             0
XSEC          85.5 85.50.50         318.3          0
              85.5 0.0329.6     5.6329.7     6.6326.0     12.5323.0    19.7320.8    23.0321.1
              85.5 28.9321.5    36.1318.4    42.7318.1    49.2316.7    55.8315.8    62.3314.8
              85.5 68.9314.4    75.5315.1    80.4315.4    85.3315.4    90.2315.4    95.1315.8
              85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
              85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
              85.5 275.6323.1334.0325.4
NS            85.5          1          2.5          2.5          2.5            1            1
NS            85.5          1            1            1            2            2            2
NS            85.5          2            2            2            2            1            1
NS            85.5          2            1            1            1            1            1
NS            85.5          1            1            1            1            1            1
NS            85.5        2.5          2.5
WSL           85.5      325.4       326.59       328.26       329.76
CAL1          85.5     322.97      2497.56
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL1      85.5
VEL1      85.5
VEL1      85.5
XSEC     177.9 92.40.30        318.3           0
         177.9 0.0329.2    11.8328.0   12.5326.4   19.7324.4   26.2323.2   29.5321.2
         177.9 32.8319.2   36.1316.6   39.4314.1   42.7312.4   45.9313.4   49.2312.6
         177.9 52.5312.8   55.8313.1   59.1313.1   62.3313.1   65.6313.1   68.9313.2
         177.9 75.5313.8   82.0316.8   88.6318.7   95.1319.8101.7320.0111.5320.6
         177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
         177.9 317.3325.2
NS       177.9         2           2           2           2           2           2
NS       177.9         2           2           2           2         2.5         2.5
NS       177.9         2           2           2           2           2           2
NS       177.9         2           1           1           1           1           1
NS       177.9         1           1           1           1           2         2.5
NS       177.9       2.5
WSL      177.9    325.53      326.72      328.37      329.86
CAL1     177.9    323.25     2497.56
VEL1     177.9
VEL1     177.9
VEL1     177.9
XSEC       454 276.20.50       318.3           0
           454 0.0330.1    2.5330.0    2.6323.5    6.6321.7    9.0319.6    13.1317.6
           454 16.4317.6   19.7316.5   23.0316.0   26.2316.2   29.5316.2   32.8316.7
           454 36.1317.1   39.4318.0   42.7318.6   45.9319.0   49.2319.1   54.5319.4
           454 59.1320.1   65.6320.3   70.2320.3   78.7320.8   85.3320.6   91.9321.1
           454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
           454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
           454 345.1325.7360.9326.6
NS         454         1         2.5         2.5         2.5         2.5         2.5
NS         454       2.5         2.5         2.5         2.5         2.5         2.5
NS         454       2.5           2           2           2         2.5         2.5
NS         454         2         2.5           2           2           2           2
NS         454         2           2           2           2           2           2
NS         454         2           2           2         2.5           2           1
NS         454         1           1
WSL        454    326.09      327.34      329.02      330.51
CAL1       454    323.55     2497.56
VEL1       454
VEL1       454
```

TABLE VII-7

FILES FOR FLOW SIMULATIONS WITH JUVENILE-COVER DATA IN REACH 4 WERE R4LOFRY.IFG, R4MDFRY.IFG, AND R4HIFRY.IFG, RESPECTIVELY

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```
VEL1      454
VEL1      454
XSEC      732 277.90.50        319.1       0
          732 0.0327.4    3.6327.7    3.7324.8    4.9324.6    6.2324.0    8.2322.2
          732 10.2321.4   13.1320.1   19.7319.1   26.2319.5   32.8319.8   39.4320.1
          732 45.9319.8   52.5319.9   59.1320.3   65.6320.1   72.2320.3   78.7320.1
          732 85.3320.3   91.9320.1   98.4320.3108.3320.3118.1320.3128.0320.5
          732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
          732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS        732          1         2.5         2.5         2.5         2.5         2.5
NS        732        2.5         2.5         2.5         2.5         2.5         2.5
NS        732        2.5         2.5         2.5         2.5         2.5         2.5
NS        732        2.5         2.5         2.5         2.5         2.5         2.5
NS        732        2.5         2.5         2.5         2.5         2.1         2.5
NS        732        2.5         2.5         2.5           1           1           1
WSL       732     326.43      327.62      329.19      330.53
CAL1      732     324.04     2497.56
VEL1      732
VEL1      732
VEL1      732
XSEC    923.4 191.40.00        319.1       0
        923.4 0.0328.3    12.8324.2   16.4322.1   22.0318.7   23.5317.1   36.1316.2
        923.4 42.7316.6   49.2317.4   55.8318.2   62.3318.7   68.9319.2   75.5319.3
        923.4 82.0319.5   88.6319.5   95.1319.6101.7319.9108.3320.0114.8320.4
        923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
        923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
        923.4 282.2325.2364.2326.5374.0326.6
NS      923.4        2.5         2.5           2           2           2           2
NS      923.4          2           2           1           1           1           1
NS      923.4          1           1           1           1           1           1
NS      923.4          1           1           1           1           1           1
NS      923.4          1           1           2         2.5         2.5         2.5
NS      923.4        2.5         2.5         2.5
WSL     923.4     326.54      327.71      329.26      330.59
CAL1    923.4     324.24     2497.56
VEL1    923.4
VEL1    923.4
VEL1    923.4
ENDJ
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
LOW velocity calibration deck t1 to t6 reach 4
ADULT    23/1/93      JJH
IOC                110010010000100000000
QARD                150
QARD                300
QARD                450
QARD                671
XSEC                  0 0.00.50        318.1       0.003
                      0 0.0329.2    9.0329.2    9.1325.7    13.1324.4   18.0322.6   23.3321.0
                      0 29.5319.9   39.4320.0   49.2319.8   59.1320.0   68.9319.4   78.7319.3
                      0 88.6319.2   98.4319.6105.0319.2111.5319.6118.1319.7124.7319.3
                      0 131.2318.5137.8318.2144.4318.1150.9318.2157.5318.6164.0319.0
                      0 170.6319.8177.2320.8179.5321.0201.1322.6203.4322.4236.2323.3
                      0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                    0          1         2.5         2.5         2.5         2.5         2.5
NS                    0        2.5         2.5           1           1           1           1
NS                    0          1           2         2.5         2.5           1         2.5
NS                    0          1           1           1           1           1           1
NS                    0          1           1           1           1           1           1
NS                    0          1           1           1           1           1
WSL                   0     319.99      320.37      320.64      320.96
CAL1                  0     320.96      671.54
VEL1                  0                                                                         0.87        1.08        0.98         0.8        1.31        1.49
VEL1                  0       1.85        1.94        1.74        2.51        3.26        4.63  4.03        4.18        3.94        3.89        4.13        3.67
VEL1                  0        2.9        0.69
CAL2                  0     322.57     2742.17
VEL2                  0
VEL2                  0
VEL2                  0
CAL3                  0     325.16      6859.5
XSEC               85.5 85.50.50       318.1       0.0045
                   85.5 0.0329.6    5.6329.7    6.6326.0    12.5323.0   19.7321.1   23.0321.7
                   85.5 28.9321.1   36.1319.5   42.7318.6   49.2316.5   55.8314.6   62.3313.3
                   85.5 68.9312.1   75.5311.4   80.4311.5   85.3312.5   90.2313.0   95.1313.7
                   85.5 101.7315.1108.3317.3114.8318.6121.4319.0128.0319.8134.5320.5
                   85.5 144.4321.1164.0322.3187.7323.0196.9322.9229.7323.4262.5323.2
                   85.5 275.6323.1334.0325.4
NS                 85.5          1         2.5         2.5         2.5           1           1
NS                 85.5          1           1           1           1           2           2
NS                 85.5          2           2           2           2           1           1
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
NS          85.5        1         1         1         1         1         1
NS          85.5        1         1         1         1         1         1
NS          85.5        1         1
WSL         85.5   320.04    320.46    320.76    321.11
CAL1        85.5   321.12    671.54
VEL1        85.5                                                                0.31      0.37      0.9      0.82      1.06
VEL1        85.5     1.42      1.54      1.5       1.44      1.41      1.54      1.56      1.64      1.64      1.63      1.38      1
VEL1        85.5
CAL2        85.5   322.97   2742.17
VEL2        85.5
VEL2        85.5
VEL2        85.5
CAL3        85.5   325.38    6859.5
XSEC       177.9 92.40.40      318.1    0.0026
           177.9 0.0329.2   11.8328.0  12.5326.4  19.7324.4  26.2323.3  29.5321.1
           177.9 32.8318.5  36.1316.8  39.4314.3  42.7312.6  45.9313.9  49.2312.6
           177.9 52.5311.9  55.8312.4  59.1312.2  62.3312.2  65.6312.5  68.9312.5
           177.9 75.5314.0  82.0317.0  88.6318.1  95.1319.2101.7320.3111.5321.1
           177.9 134.5322.0167.3322.5182.7323.3200.1323.2232.9323.5278.9323.5
           177.9 317.3325.2
NS         177.9        2         2         2         2         2         2
NS         177.9        2         2         2         2         2         2
NS         177.9        2         2         2         1         2         2
NS         177.9        1         1         1         1         1         1
NS         177.9        1         1         1         1         2       2.5
NS         177.9      2.5
WSL        177.9   320.05    320.47    320.77    321.14
CAL1       177.9   321.14    671.54
VEL1       177.9                                                                0.28      2.32      2.5      2.54      2.54      2.31
VEL1       177.9     2.23      2.17        2       1.66      1.46      1.1       0.58      0.38      0.3      0.14      0
VEL1       177.9
CAL2       177.9   323.25   2742.17
VEL2       177.9
VEL2       177.9
VEL2       177.9
CAL3       177.9   325.48    6859.5
XSEC         454 276.20.50     318.1     0.003
             454 0.0330.1   2.4330.0   2.5324.4   6.6322.2   9.0321.3  13.1318.6
             454 16.4317.3  19.7316.5  23.0316.0  26.2316.2  29.5316.4  32.8316.7
             454 36.1317.3  39.4317.3  42.7318.4  45.9318.9  49.2319.1  52.5319.4
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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	454	59.1319.8	65.6320.0	72.2320.4	78.7320.5	85.3320.6	91.9320.9						
	454	98.4321.1105.0321.2111.5321.1118.1321.2119.4321.3150.9321.7											
	454	183.7322.4216.5323.1236.2323.5249.3323.9282.2324.3323.2324.6											
	454	345.1325.7360.9326.6											
NS	454	1	2.5	2.5	2.5	2.5	2.5						
NS	454	2	1	1	1	1	1						
NS	454	1	1	1	1	2	1						
NS	454	1	1	1	1	1	1						
NS	454	1	1	1	1	1	1						
NS	454	1	1	1	1	2	1						
NS	454	1	1										
WSL	454	320.09	320.56	320.9	321.28								
CAL1	454	321.27	671.54										
VEL1	454						2.92	4.59	4.76	5.33	5.09	4.59	4.02
VEL1	454	3.61	3.05	2.56	2.62	2.56	2.23	1.77	1.15	0.82	0.66	0.36	0.16
VEL1	454	0	0	0	0								
VEL1	454												
CAL2	454	323.55	2742.17										
VEL2	454												
VEL2	454												
VEL2	454												
VEL2	454												
CAL3	454	326.02	6859.5										
XSEC	732	277.90.50	319.1	0.0027									
	732	0.0327.4	3.6327.7	3.7324.8	4.9324.6	6.2324.0	8.2322.2						
	732	10.2321.9	13.1320.3	19.7319.1	26.2319.5	32.8319.7	39.4319.9						
	732	45.9320.3	52.5320.0	59.1319.9	65.6319.7	72.2319.9	78.7320.2						
	732	85.3320.3	91.9320.1	98.4320.1108.3320.3118.1320.4128.0320.3									
	732	137.8320.5147.6320.9157.5321.3167.3321.8169.9321.9196.9322.7											
	732	229.7323.6237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5											
NS	732	1	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	1	2	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2.5						
NS	732	2.5	2.5	2.5	2.5	2.5	2						
NS	732	1	1	1	1	1	1						
NS	732	1	1	1	1	1	1						
WSL	732	320.8	321.91	321.52	321.91								
CAL1	732	321.91	671.54										
VEL1	732								1.52	2.59	2.21	2.21	2.46
VEL1	732	2.7	2.63	2.63	2.49	2.58	2.27	2.52	2.21	1.96	2.02	2.11	2

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
VEL1       732      1.61       1.4      0.91         0
CAL2       732    324.03   2742.17
VEL2       732
VEL2       732
VEL2       732
CAL3       732    326.43    6859.5
VEL3       732
VEL3       732
VEL3       732
XSEC     923.4 191.40.00     319.1     0.001
         923.4 0.0328.3    12.8324.2  16.4322.1  22.5316.9  23.0319.5  36.1316.5
         923.4 42.7316.7   49.2317.4  55.8318.1  62.3318.5  68.9319.0  75.5319.6
         923.4 82.0319.5   88.6319.5  95.1319.6101.7319.7108.3320.1114.8320.3
         923.4 121.4320.4128.0320.8134.5321.1141.1321.4147.6321.7154.9322.1
         923.4 164.0322.6180.4323.4193.9324.2196.9324.4229.7326.2262.5326.6
         923.4 282.2325.2364.2326.5374.0326.6
NS       923.4       2.5       2.5         2         2         1         1
NS       923.4         1         1         1         1         1         1
NS       923.4         1         1         1         1         1         1
NS       923.4         1         1         1         1         1         1
NS       923.4         1         1         1         2       2.5       2.5
NS       923.4       2.5       2.5       2.5
WSL      923.4     320.9    321.96    321.69     322.1
CAL1     923.4    321.93    671.54
VEL1     923.4                                  1.32      1.67      1.78      1.78      1.72       1.7      1.74      1.73       1.7
VEL1     923.4      1.71      1.46      1.28      1.35      1.08      1.13      0.83      0.74      0.68      0.39      0.17
VEL1     923.4
CAL2     923.4    324.24   2742.17
VEL2     923.4
VEL2     923.4
VEL2     923.4
CAL3     923.4    326.54    6859.5
VEL3     923.4
VEL3     923.4
VEL3     923.4
ENDJ
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
med flow red deer river t1 to t4 reach 4 (T3 NS corrected by Vadas)
ADULT2  MED      FLOW            FEB 4          1993
IOC             11001000000010000000
QARD            1554
QARD            2437
QARD            4648
XSEC                0 0.00.50          318.3         0
                    0 0.0329.2    9.0329.2    9.1325.7    13.1324.4   18.0322.6   23.3321.1
                    0 29.5320.1   39.4320.3   49.2320.1   59.1320.2   68.9320.0   78.7319.6
                    0 88.6319.5   98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                    0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                    0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                    0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS                  0          1         2.5         2.5         2.5         2.5         2.5
NS                  0        2.5         2.5           1           1           1           1
NS                  0          1           2         2.5         2.5           1         2.5
NS                  0          1           1           1           1           1           1
NS                  0          1           1           1           1           1           1
NS                  0          1           1           1           1           1
CAL1                0     320.96      671.54
CAL2                0     322.57      2497.6
VEL2                0                                                                   4.43      4.87      4.92      5.13      5.07      5.79      5.36
VEL2                0       5.04        5.61        6.19        5.49        4.99        5.24      6.23      5.94      5.82      5.05      5.36      4.89
VEL2                0       4.83        3.51        3.22
CAL3                0     325.16      6859.5
XSEC             85.5 85.50.50         318.3         0
                 85.5 0.0329.6    5.6329.7    6.6326.0    12.5323.0   19.7320.8   23.0321.1
                 85.5 28.9321.5   36.1318.4   42.7318.1   49.2316.7   55.8315.8   62.3314.8
                 85.5 68.9314.4   75.5315.1   80.4315.4   85.3315.4   90.2315.4   95.1315.8
                 85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
                 85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
                 85.5 275.6323.1334.0325.4
NS               85.5          1         2.5         2.5         2.5           1           1
NS               85.5          1           1           1           1           2           2
NS               85.5          2           2           2           2           1           1
NS               85.5          1           1           1           1           1           1
NS               85.5          1           1           1           1           1           1
NS               85.5          1           1
CAL1             85.5     321.12      671.54
CAL2             85.5     322.97      2497.6
VEL2             85.5                                                  0.72         0.46      0.36      1.73      2.14      2.73       3.8      4.84
VEL2             85.5        5.5        5.19        5.06         4.8          4.7         4.83      4.83       4.7      4.66      3.91      2.47       2.8
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
VEL2       85.5      1.67      1.33
CAL3       85.5    325.38    6859.5
XSEC      177.9 92.40.30      318.3         0
          177.9 0.0329.2  11.8328.0 12.5326.4 19.7324.4 26.2323.2 29.5321.2
          177.9 32.8319.2 36.1316.6 39.4314.1 42.7312.4 45.9313.4 49.2312.6
          177.9 52.5312.8 55.8313.1 59.1313.1 62.3313.1 65.6313.1 68.9313.2
          177.9 75.5313.8 82.0316.8 88.6318.7 95.1319.8101.7320.0111.5320.6
          177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
          177.9 317.3325.2
NS        177.9         2         2         2         2         2         2
NS        177.9         2         2         2         2         2         2
NS        177.9         2         2         2         1         2         2
NS        177.9         1         1         1         1         1         1
NS        177.9         1         1         1         1         2       2.5
NS        177.9       2.5
CAL1      177.9    321.14    671.54
CAL2      177.9    323.25    2497.6
VEL2      177.9                                                   0.34      1.49       4.8      5.43      5.13      5.64      5.74
VEL2      177.9      5.87      5.77      5.53      5.41      5.19      5.21      4.66       4.1      3.83      3.44      3.37      2.88
VEL2      177.9      1.74      0.73
CAL3      177.9    325.48    6859.5
XSEC        454 276.20.50     318.3         0
            454 0.0330.1  2.5330.0  2.6323.5  6.6321.7  9.0319.6  13.1317.6
            454 16.4317.6 19.7316.5 23.0316.0 26.2316.2 29.5316.2 32.8316.7
            454 36.1317.1 39.4318.0 42.7318.6 45.9319.0 49.2319.1 54.5319.4
            454 59.1320.1 65.6320.3 70.2320.3 78.7320.8 85.3320.6 91.9321.1
            454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
            454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
            454 345.1325.7360.9326.6
NS          454         1       2.5       2.5       2.5       2.5       2.5
NS          454         2         1         1         1         1         1
NS          454         1         1         1         1         2         1
NS          454         1         1         1         1         1         1
NS          454         1         1         1         1         1         1
NS          454         1         1         1         1         2         1
NS          454         1         1
CAL1        454    321.27    671.54
CAL2        454    323.55    2497.6
VEL2        454                                 0      1.35       4.6      4.65       5.1       5.4      5.52      5.27      5.27
VEL2        454      5.12      4.67      5.02      5.06      4.92      4.88      4.98      5.01      4.96      4.55      4.42      4.04
VEL2        454      4.41      4.05      4.31         4      4.69         0         0         0
CAL3        454    326.02    6859.5
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
XSEC      732 277.90.50        319.1         0
          732 0.0327.4   3.6327.7   3.7324.8   4.9324.6   6.2324.0   8.2322.2
          732 10.2321.4  13.1320.1  19.7319.1  26.2319.5  32.8319.8  39.4320.1
          732 45.9319.8  52.5319.9  59.1320.3  65.6320.1  72.2320.3  78.7320.1
          732 85.3320.3  91.9320.1  98.4320.3108.3320.3118.1320.3128.0320.5
          732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
          732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS        732          1       2.5       2.5       2.5       2.5       2.5
NS        732        2.5       2.5         1         2       2.5       2.5
NS        732        2.5       2.5       2.5       2.5       2.5       2.5
NS        732        2.5       2.5       2.5       2.5       2.5         2
NS        732          1         1         1         1         1         1
NS        732          1         1         1         1         1         1
CAL1      732     321.91    671.54
CAL2      732     324.03    2497.6
VEL2      732                                                          0   0.18   1.06   3.73   4.06   4.28   4.66
VEL2      732        4.5      5.07      4.62      4.74      4.72      5.06   4.78   4.43   4.68   4.77   4.31   4.39
VEL2      732       3.99      4.24      3.93      3.79      3.95      2.58   0.08
CAL3      732     326.43    6859.5
XSEC    923.4 191.40.00        319.1         0
        923.4 0.0328.3   12.8324.2  16.4322.1  22.0318.7  23.5317.1  36.1316.2
        923.4 42.7316.6  49.2317.4  55.8318.2  62.3318.7  68.9319.2  75.5319.3
        923.4 82.0319.5  88.6319.5  95.1319.6101.7319.9108.3320.0114.8320.4
        923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
        923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
        923.4 282.2325.2364.2326.5374.0326.6
NS      923.4        2.5       2.5         2         2         1         1
NS      923.4          1         1         1         1         1         1
NS      923.4          1         1         1         1         1         1
NS      923.4          1         1         1         1         1         1
NS      923.4          1         1         1         2       2.5       2.5
NS      923.4        2.5       2.5       2.5
CAL1    923.4     321.93    671.54
CAL2    923.4     324.24    2497.6
VEL2    923.4                         2.65      3.86      3.53      3.96   3.68   4.15   4.25   3.93   4.23   4.04
VEL2    923.4       3.77      3.88      3.77      3.81      3.93      3.24   2.94   2.96   2.58   2.78   2.51   2.23
VEL2    923.4       1.88      0.84
CAL3    923.4     326.54    6859.5
ENDJ
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

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```
HIGH flow red deer river t1 to t4 reach 4 (T3 NS corrected by Vadas)
ADULT  HI        FLOW        FEB 4          1993
IOC       11001001000010000000
QARD       6859
QARD      10000
QARD      15000
QARD      20000
XSEC            0 0.00.50     318.3       0
                0 0.0329.2 9.0329.2 9.1325.7 13.1324. 18.0322. 23.3321.1
                0 29.5320. 39.4320. 49.2320. 59.1320. 68.9320. 78.7319.6
                0 88.6319. 98.4320.0105.0320.0111.5320.0118.1319.9124.7319.4
                0 131.2318.9137.8318.4144.4318.3150.9318.4157.5318.8164.0319.5
                0 170.6319.9177.2320.6179.5320.9201.1322.6203.4322.4236.2323.3
                0 269.0323.3304.5322.8324.1323.7337.9324.2360.2325.0
NS              0       1      2.5      2.5      2.5      2.5      2.5
NS              0     2.5      2.5        1        1        1        1
NS              0       1        2      2.5      2.5        1      2.5
NS              0       1        1        1        1        1        1
NS              0       1        1        1        1        1        1
NS              0       1        1        1        1        1
WSL             0  325.16   326.41   328.11   329.64
CAL1            0  322.57  2497.56
VEL1            0
VEL1            0
VEL1            0
XSEC         85.5 85.50.50    318.3       0
             85.5 0.0329.6 5.6329.7 6.6326.0 12.5323. 19.7320. 23.0321.1
             85.5 28.9321. 36.1318. 42.7318. 49.2316. 55.8315. 62.3314.8
             85.5 68.9314. 75.5315. 80.4315. 85.3315. 90.2315. 95.1315.8
             85.5 101.7315.8108.3318.1114.8319.2121.4319.6128.0319.8134.5320.5
             85.5 144.4321.3164.0322.2187.7323.0196.9322.9229.7323.4262.5323.2
             85.5 275.6323.1334.0325.4
NS           85.5       1      2.5      2.5      2.5        1        1
NS           85.5       1        1        1        1        2        2
NS           85.5       2        2        2        2        1        1
NS           85.5       1        1        1        1        1        1
NS           85.5       1        1        1        1        1        1
NS           85.5       1        1
WSL          85.5   325.4   326.59   328.26   329.76
CAL1         85.5  322.97  2497.56
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

(Page 9 of 10)

```
VEL1        85.5
VEL1        85.5
VEL1        85.5
XSEC       177.9 92.40.30    318.3       0
           177.9 0.0329.2 11.8328.  12.5326.  19.7324.  26.2323.  29.5321.2
           177.9 32.8319.  36.1316.  39.4314.  42.7312.  45.9313.  49.2312.6
           177.9 52.5312.  55.8313.  59.1313.  62.3313.  65.6313.  68.9313.2
           177.9 75.5313.  82.0316.  88.6318.  95.1319.8101.7320.0111.5320.6
           177.9 134.5321.9167.3322.9182.7323.2200.1323.2232.9323.5278.9323.5
           177.9 317.3325.2
NS         177.9        2        2        2        2        2        2
NS         177.9        2        2        2        2        2        2
NS         177.9        2        2        2        1        2        2
NS         177.9        1        1        1        1        1        1
NS         177.9        1        1        1        1        2      2.5
NS         177.9      2.5
WSL        177.9   325.53   326.72   328.37   329.86
CAL1       177.9   323.25  2497.56
VEL1       177.9
VEL1       177.9
VEL1       177.9
XSEC         454 276.20.5    318.3       0
             454 0.0330.1 2.5330.0 2.6323.5 6.6321.7 9.0319.6 13.1317.6
             454 16.4317.  19.7316.  23.0316.  26.2316.  29.5316.  32.8316.7
             454 36.1317.  39.4318.  42.7318.  45.9319.  49.2319.  54.5319.4
             454 59.1320.  65.6320.  70.2320.  78.7320.  85.3320.  91.9321.1
             454 98.4321.2105.0321.3111.5321.2118.1321.1119.4321.2150.9321.9
             454 183.7322.6216.5323.3236.2323.5249.3323.9282.2324.3323.2324.6
             454 345.1325.7360.9326.6
NS           454        1      2.5      2.5      2.5      2.5      2.5
NS           454        2        1        1        1        1        1
NS           454        1        1        1        1        2        1
NS           454        1        1        1        1        1        1
NS           454        1        1        1        1        1        1
NS           454        1        1        1        1        2        1
NS           454        1        1
WSL          454   326.09   327.34   329.02   330.51
CAL1         454   323.55  2497.56
VEL1         454
VEL1         454
```

TABLE VII-8

FILES FOR FLOW SIMULATIONS WITH ADULT-COVER DATA IN REACH 4 WERE R4LOADU.IFG, R4MDADU.IFG, AND R4HIADU.IFG, RESPECTIVELY

(Page 10 of 10)

```
VEL1     454
VEL1     454
XSEC     732 277.90.5    319.1         0
         732 0.0327.4 3.6327.7 3.7324.8 4.9324.6 6.2324.0 8.2322.2
         732 10.2321.  13.1320.  19.7319.  26.2319.  32.8319.  39.4320.1
         732 45.9319.  52.5319.  59.1320.  65.6320.  72.2320.  78.7320.1
         732 85.3320.  91.9320.  98.4320.3108.3320.3118.1320.3128.0320.5
         732 137.8320.8147.6321.0157.5321.5167.3321.9169.9322.1196.9322.7
         732 229.7323.8237.9324.0262.5324.3269.8324.6399.1326.3410.1326.5
NS       732        1      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5        1        2      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5      2.5
NS       732      2.5      2.5      2.5      2.5      2.5        2
NS       732        1        1        1        1        1        1
NS       732        1        1        1        1        1        1
WSL      732   326.43   327.62   329.19   330.53
CAL1     732   324.04  2497.56
VEL1     732
VEL1     732
VEL1     732
XSEC   923.4 191.40.0    319.1         0
       923.4 0.0328.3 12.8324.  16.4322.  22.0318.  23.5317.  36.1316.2
       923.4 42.7316.  49.2317.  55.8318.  62.3318.  68.9319.  75.5319.3
       923.4 82.0319.  88.6319.  95.1319.6101.7319.9108.3320.0114.8320.4
       923.4 121.4320.5128.0320.8134.5321.2141.1321.6147.6321.8154.9322.3
       923.4 164.0322.6180.4323.6193.9324.2196.9324.4229.7326.2262.5326.6
       923.4 282.2325.2364.2326.5374.0326.6
NS     923.4      2.5      2.5        2        2        1        1
NS     923.4        1        1        1        1        1        1
NS     923.4        1        1        1        1        1        1
NS     923.4        1        1        1        1        1        1
NS     923.4        1        1        1        2      2.5      2.5
NS     923.4      2.5      2.5      2.5
WSL    923.4   326.54   327.71   329.26   330.59
CAL1   923.4   324.24  2497.56
VEL1   923.4
VEL1   923.4
VEL1   923.4
ENDJ
```